JULY, 1956

modern castings

Owned by
THE MEN WHO BUY

How Cupolas Work
Review of fundamentals gives better understanding of cupola operation

Machining Aluminum Die Castings
Hard spots cause trouble but they are an easy problem to control

It's Easy to Take Inventory
Follow this plan and you can inventory even a large plant in one day

Hints for Better Pouring
Better pouring methods make better castings. This article tells how

How to Store Patterns
Neglect of facilities and records costs man-hours, space, customers

MARKETING CASTINGS
Engineered castings and a plan to sell them is subject of this month's 16-page bonus section

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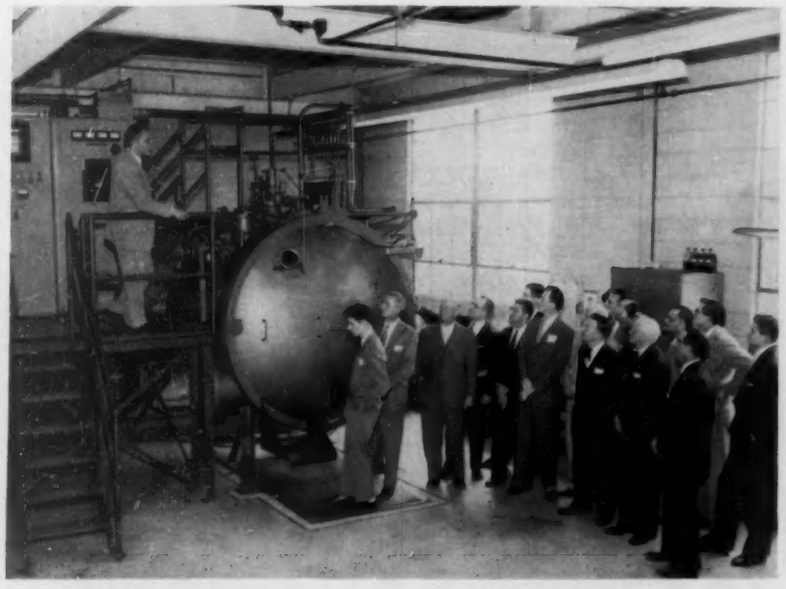
modern castings album

The high and the low of the castings industry: AFS officials who toured Atlantic City's ocean front in Wheelabrator's whirly-bird and (below) cast magnesium heels for your lady's high-fashion shoes. High-flying AFS officials and their host were: Wm. W. Maloney, general manager, AFS; Frank W. Shipley, president, AFS; O. A. Pfaff, president, Wheelabrator Corp.; and Harry W. Dietert, vice-president, AFS. Those heels were cast in magnesium by Superb Light Alloys, Farmingdale, N.Y., for designers who want 'em thin. (1) is a breakable, wooden heel. It is the thinnest made. (2) is what the designers want. (3) is a early effort at casting a magnesium heel. (4) has been redesigned for strength and castability and (5 and 6) are production models.

1 2 3 4 5 6

COURTESY "THE MAGAZINE OF MAGNESIUM," BROOKS AND PERKINS, INC.

Production of investment casting alloys by vacuum melting was shown to magazine editors in a recent tour of Cannon-Muskegon, Inc., alloy supplier. Chief metallurgist Ken Iverson explains furnace designed by staff engineers. Second and third from left are George W. Cannon, Jr., company president, and George Cannon, Sr., retired co-founder and officer of Campbell, Wyant and Cannon Foundry.



Directors of the Gray Iron Founder's Society at a board meeting at the Homestead, Hot Springs, Va., were: standing, D. H. Workman, executive vice-president; R. G. Schaefer; W. S. Brunk; W. E. Illig; H. J. Trenkamp; E. T. White; W. Z. Taylor; and C. S. Wieland. Seated: A. H. Renfrow, secretary; C. H. Meminger, vice-president; C. H. Ker, president; J. S. Parrish, Jr.; W. O. Larson, treasurer; E. M. Knapp; and A. M. Nutter.

Sand School Bells Will Ring

The influence of sand on foundry costs will be the theme for the annual Sand School for supervisory and technical personnel to be held in Detroit, August 20-22, at the Detroit Engineering Society under the sponsorship of the Harry W. Dietert Co.

Students attending the course will be presented solutions to two basic problems: how to increase the ease with which a coremaker or molder can work by compounding a readily worked sand, and how to improve casting quality and scrap loss by proper selection and control of sand. Solutions to these basic problems will be based on studies of six sand properties: structural, green, air-set, dry, hot, and retained.

The lectures will be given by Victor M. Rowell, Harry W. Dietert Co. There will be no charge for those attending the course.

Talks to Tell of Titanium

The second annual titanium lecture program designed for practicing engineers will be conducted at the New York University College of Engineering September 10-14.

Authorities on titanium from industry and research laboratories, together with members of the NYU faculty, will present 25 lectures. The list of speakers includes the two leading British authorities on titanium, Dr. Allan D. McQuillan, University of Birmingham, and his wife, Marian McQuillan, Imperial Chemical industries.

Attendance at the NYU lecture program will be limited and all applicants must register by August 15. Further information and applications can be obtained from Dr. Harold Margolin, New York University College of Engineering, University Heights 53, N. Y.

Answer questions by sending for data describing the newest products and processes. Order by using the cards on **page 13-14.**

products and processes

Combination starters now incorporate smaller E-frame circuit breakers rated 250 v, 100 amp max. Breaker has an interrupting capacity of 7500 amps and is supplied on GE CR 7008 combination starters, CR 7010 combination reversing starters and CR 7108 combination multi-speed starters in sizes 0-3. *General Electric Co.*

CIRCLE NO. 1, PAGE 13-14

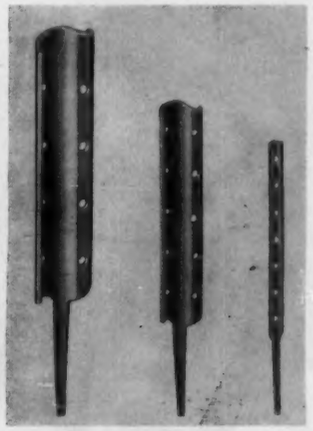
X-ray film called type AA has all the fine sensitivity of type A plus a greatly reduced exposure need. It will cut exposure time, give increased sensitivity through higher densities, give greater contrast, shorten the processing cycle, and lessen the chance of pressure desensitization. *Eastman Kodak Co.*

CIRCLE NO. 2, PAGE 13-14

Sand coating muller gives rapid coating or blending of sand with liquid or dry resin. The Model SCM-3 comes in three capacities: 125, 300, and 1000 pounds. *Shallway Corp.*

CIRCLE NO. 3, PAGE 13-14

Chills in three widths and a variety of lengths have a curved S shape and holes to give 75% more chilling



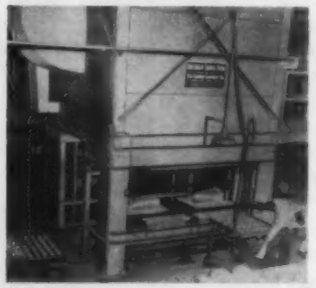
surface with less weight. Called Fan-S-Chills, they come in copper, aluminum, or tin coat. *Fanner Mfg. Co.*

CIRCLE NO. 4, PAGE 13-14

Roll clamp attachment for maker's line of fork trucks picks up tubular items, rotates them 90 degrees if desired. Curved shoes are sand-blasted for sure grip. *Towmotor Corp...*

CIRCLE NO. 5, PAGE 13-14

Tower oven gives faster baking with less fuel due to a more efficient cycle, the maker states. It embodies a



new principle in handling internal recirculation of both heated and cooled air. *The Foundry Equipment Co.*

CIRCLE NO. 6, PAGE 13-14

Bin vibrator is small and silent, designed for lightweight applications. The RC-5 weighs 25 lbs, draws 100 watts on all common ac voltages. It delivers a 275-lb impact. *Cleveland Vibrator Co.*

CIRCLE NO. 7, PAGE 13-14

Liquid core paste has been improved for more viscosity and less settling. Fastick still maintains its best features: high tensile strength, low gas evolution, fast drying, low cost, uniformity. *Frederic B. Stevens, Inc.*

CIRCLE NO. 8, PAGE 13-14

Conversion coat for aluminum and zinc meets Specification MIL C-5541 and is called ChromiCoat. Rust is confined to open surfaces, since it can't creep under the edge of the coating. *Oakite Products, Inc.*

CIRCLE NO. 9, PAGE 13-14

Exhaust silencer is intended to give extra quiet operation to the maker's cabinet-type dust collectors. It comes

in 5 models to fit exhaust openings on the Torit 50, 60, 70, and 80 series, and the Model 122 collectors. *Torit Mfg. Co.*

CIRCLE NO. 10, PAGE 13-14

Industrial truck with torque converter handles 1½ tons. The M30 Prime Mover has top speed of 12 mph, with higher speeds on special gearing. A

15 hp air-cooled engine runs it. Standard beds include an 18 cu ft bulk bed and a 42 by 42" flatbed. *The Prime-Mover Co.*

CIRCLE NO. 11, PAGE 13-14

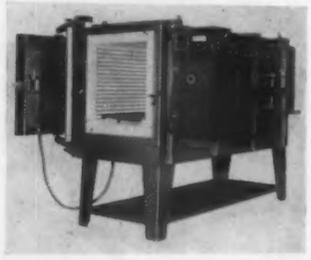
Saw attachment for rotary drills cuts holes from 1 to 2½" diameters in wood, plastic, or metal. Hole Saw blades are tempered, high-carbon steel which fit into grooves and are held by a set screw. Cut depth is ¾". *Aladdin Mfg. Co.*

CIRCLE NO. 12, PAGE 13-14

Electric contact extensometer can be used to improve creep testing machines. The component is more stable, and can handle extension or contraction. *Baldwin-Lima-Hamilton Corp.*

CIRCLE NO. 13, PAGE 13-14

Electric furnace designated P2472-1 is designed for many critical temperature heat treating operations. Interior



dimensions are 24 by 24 by 72" long. Six zones are controlled individually for precise control of furnace gradient. *L&L Mfg. Co.*

CIRCLE NO. 14, PAGE 13-14

Slinger belt is thinner and has no top or bottom covers of rubber. This actually makes it last longer. Belts come in 3 sizes, all endless, all 4-ply:

24" wide by 7' 10"; 10" wide by 6'; 16" wide by 5' 8" long. *Thermoid Co.*
CIRCLE NO. 15, PAGE 13-14

Disc sanders and grinders are available in sizes from 16 to 36" with single and double disc models in each

size. Many attachments and accessories multiply their usefulness. *Max Manufacturing Co.*
CIRCLE NO. 16, PAGE 13-14

Anti-rust compound called NoRuSol is water soluble and protects parts so that can be stored about a month indoors. A 3% solution can be sprayed on, or parts can be dipped in. A mild cleaner takes it off if desired. *International Chemical Co.*
CIRCLE NO. 17, PAGE 13-14

Clamshell bucket line has been expanded by 2 new models. One is a 3/8 to 4-yd light rehandler, the other

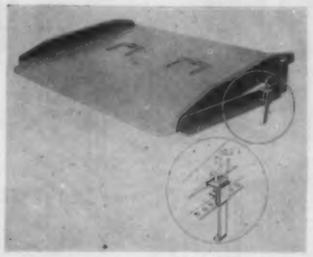
is a 3/8 to 2-yd extra heavy duty hard digger. These 2-line models can be adapted for 3- or 4-line operation if desired. *Erie Strayer Co.*
CIRCLE NO. 18, PAGE 13-14

Epoxy pastes for patching, filleting, and sealing are designated Epocast

150 to 156. They have outstanding adhesion with negligible shrinkage. *Furane Plastics, Inc.*

CIRCLE NO. 19, PAGE 13-14

Bridge ramp has a modification to prevent breaking or bending the locking device and stops. Ramps will take



up to 15,000 lbs, come in a variety of sizes and shapes, are made of all-welded steel. *Elizabeth Iron Works.*

CIRCLE NO. 20, PAGE 13-14

Belt grinder is reported to increase production by 25% over old methods. Model 500 mounts anywhere with

only 4 bolts; it takes at least 1 hp. The contact wheel can be rotated through a full circle. *B&E Mfg. Co., Inc.*

CIRCLE NO. 21, PAGE 13-14

Electric truck features straddle bar tiller for steering from standing position. Designed for narrow aisles, the Taylortruck Model N turns in a 69" radius. It comes in 3- and 4-wheel

models. The 1½ hp electric motor moves it at 12 mph max. Six forward, 6 reverse speeds. *Taylor Mfg. Co.*

CIRCLE NO. 22, PAGE 13-14

Radiation detector gives both cumulative and instantaneous readings of gamma rays. The Radad Detector is recharged by shaking until indicator beads become electrostatically charged. At dangerous limits the

beads fall to the bottom of the tube. *Pacific Transducer Corp.*

CIRCLE NO. 23, PAGE 13-14

Elevator for free-flowing materials such as sand, flux, and gravel is called "Hi-Lift Cableveyor-Elevator." It comes with 4, 8, or 12" diameter tubes, can be built to almost any practicable height. A string of buckets does the lifting. *Hapman Conveyors, Inc.*

CIRCLE NO. 24, PAGE 13-14

Universal tester plots the load applied as well as load vs. extension or time. Switch gives choice of 12 test ranges. Electronic drive gives positive loading speed at all times. *Tinius Olsen Testing Machine Co.*

CIRCLE NO. 25, PAGE 13-14

Temperature indicating liquids now feature greatly reduced settling characteristics. These Tempilaqs range in temperature rating from 113 to 2000 F. *Tempil Corp.*

CIRCLE NO. 26, PAGE 13-14

Four new respirators protect against inhaling all nonvolatile airborne particles—dusts, spray, mists, and fumes. Each also protects against specific vapors and volatile particles. They're the R5561, R5562, R5563, R5564. *American Optical Co.*

CIRCLE NO. 27, PAGE 13-14

Six-inch grinder weighs 10½ lbs without guard and is rated at 3 hp. The 2000 grinder can use straight type abrasive wheels or flanged cup wheels. Two keys handle torque transmission and balancing. *Cleco Div., Reed Roller Bit Co.*

CIRCLE NO. 28, PAGE 13-14

Flow control valves for air, water, oil or freon work automatically or manually. The "Quick-Dump" line works with pressure, not against it, to give better performance. They work at pressures to 125 psi, temperatures from -40 to 225 F. Seven models. *Humphrey Products.*

CIRCLE NO. 29, PAGE 13-14

Wet cutting blades cut the entire range of masonry products from hard to soft. They're reinforced with fibre glass, have 14" diameters, wide range of specifications. Name: CBR-500 Series. *Clipper Mfg. Co.*

CIRCLE NO. 30, PAGE 13-14

Compression tester gives results in 3 ranges without interrupting the test. Ranges are full capacity of 500,000

CIRCLE NO. 137, PAGE 13-14

lbs, 1/5 capacity, and 1/20 capacity. Load is shown electronically on large 28" dial mounted on the Super L tester. *Tinius Olsen Testing Machine Co.*

CIRCLE NO. 31, PAGE 13-14

Aluminum oxide cement known as Kellundite No. 8 provides a more heat-resistant, longer-lasting lining for indirect arc-type electric furnaces. The linings weigh from 500 to 1000 lbs, and the material can also be used for patching. *Electro Refractories & Abrasives Corp.*

CIRCLE NO. 32, PAGE 13-14

Fork trucks come in a new line with capacities from 2000 to 4000 lbs. The new Safe-Hite series are electrically powered. Big feature is that the battery compartment is lower, which makes the operator sit 18" lower than usual. Overall height is less, too. *Elwell-Parker Electric Co.*

CIRCLE NO. 33, PAGE 13-14

Automatic tester will maintain a fixed extension or strain when testing at elevated temperatures. It's the exact opposite of the familiar creep tester; the load changes to compensate for changing properties. *Tinius Olsen Testing Machine Co.*

CIRCLE NO. 34, PAGE 13-14

Car-bottom electric furnaces for annealing bar stock, tubes, forgings, steel castings, and welded structures contains heating units made of ribbon resistor with a heavy cross section. *General Electric Co.*

CIRCLE NO. 35, PAGE 13-14

Dielectric core oven bakes 120-lb and heavier cores in an 11-minute cycle. It's the CD-150, and one of the largest used in the foundry industry. Other models have capacities of 30, 60, and 75 KW. *The Foundry Equipment Co.*

CIRCLE NO. 36, PAGE 13-14

Oil coolers for hydraulic systems feature high rate of heat transfer per unit of space occupied. Designated Series OCW, water type units handle oil flows to 100 gpm. Series OCA units are air type, handle oil flows to 70 gpm. *Vickers Inc.*

CIRCLE NO. 37, PAGE 13-14

Hacksaw has special construction to combine many features of the hack, coping, and keyhole saw. Depth of cut is unlimited since the whole frame stays on the operator's side of the

CIRCLE NO. 137, PAGE 13-14

material. Leytool Hacksaw weighs 1⅛ lbs, takes standard 10 or 12″ blades. *Hallbee Products Co.*

CIRCLE NO. 38, PAGE 13-14

Spray lubricant for open gears and cable is known as Tenac. It sprays on to form a continuous film under all loads and speeds; tests show it gets even tougher while in use. *Krylon, Inc.*

CIRCLE NO. 39, PAGE 13-14

Pneumatic muffler for air-operated equipment features a 4-port deflector and a new disseminator to improve air flow and efficiency. "Atomuffler" comes in sizes from 1/8 to 2″ NPT. *Allied Witan Co., Inc.*

CIRCLE NO. 40, PAGE 13-14

Tread plate is made of non-skid abrasive aluminum to give sure footing even when covered with oil, grease, or water. They're for steps and aisles, and wherever dangerous slipping hazards exist. *Aluminum Company of America.*

CIRCLE NO. 41, PAGE 13-14

Radiography unit called Series 50 Multitron is for gamma isotope applications. It's designed for panoramic exposures where several specimens are arranged around the source, and for internal exposures. It can hold up to 4 different radioactive sources. *The Budd Co.*

CIRCLE NO. 42, PAGE 13-14

Multiple tube collector has more efficiency and greater flow than conventional units. The Cyclo-trell consists of cyclone tubes in parallel, and works through centrifugal force. *Research-Cottrell, Inc.*

CIRCLE NO. 43, PAGE 13-14

Conversion kit fits all makes of fork trucks for LP-gas operation. Hendrix Kit is installed in 3 or 4 hours, is safe; it consists of fuel cylinder bracket, toggle and strap, all necessities. *Industrial Gastruck, Inc.*

CIRCLE NO. 44, PAGE 13-14

Oil gun for standard lubrication fittings is reported to be the first hand-operated high pressure unit. It affords positive pressure lubrication, as well as flushing of bearings which require periodic care. *Lincoln Engineering Co.*

CIRCLE NO. 45, PAGE 13-14

Industrial filter called the IWF has high-flow backwash design which makes disassembly for cleaning unnecessary. Air trapped in the high

CIRCLE NO. 138, PAGE 13-14

dome forces backwash fluid through elements at high velocities, purging all foreign matter. *The R. P. Adams Co.*

CIRCLE NO. 46, PAGE 13-14

Diesel compressor line now includes 6 models ranging from 330 to 3220 cfm. All are L-shaped, 2-stage, double-acting types, fully counter-balanced. They act at lower speeds to improve life and efficiency. They're known as the AR line. *Atlas Copco Pacific Inc.*

CIRCLE NO. 47, PAGE 13-14

Foundry resins for coating sand in shell molding are phenolics known as Resinox. Each is slightly different to handle different situations; two are liquids, two are powders. One is for hot-coating. *Plastics Div., Monsanto Chemical Co.*

CIRCLE NO. 48, PAGE 13-14

Sand slinger cups are made of high chromium, high vanadium die steels. On job tests, the Sling-Mor Cups have outlasted standard cups 10 to 1. Two sizes fit most machines. *Special Products Div., Latrobe Steel Co.*

CIRCLE NO. 49, PAGE 13-14

Standby lantern is powered by two standard 6-volt batteries in parallel. Unit is self-contained, lasts up to 4 times as long as the usual battery lantern. It's called the Radar-Lamp. *Burgess Battery Co.*

CIRCLE NO. 50, PAGE 13-14

Repair tools for conveyor belts include templets, a boring bit, and an alloy steel wrench to fit in standard impact tools. Their use cuts in half the time usually needed to apply fasteners by the hand method. *Flexible Steel Lacing Co.*

CIRCLE NO. 51, PAGE 13-14

Name Contest Winner

Forest W. Hanson, Mohawk Foundries, Cleveland, Ohio, won a six-foot scale model convertible automobile offered as a prize in a contest conducted by Beardsley & Piper at the AFS Castings Congress and Show in Atlantic City.

Over 4000 Congress-goers attempeted to guess the number of tons of sand handled by four pieces of Beardsley & Piper equipment on display. Hanson's answer of 509,500 tons was just 4,047 tons short of the correct total of 513,547 tons of foundry sand handled by the four samples.

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Mg Group Names Officers

The Magnesium Association named its officers for the 1956-57 year at its annual meeting in Colorado Springs, Colorado, May 31 and June 1. D. T. Wellman, Wellman Bronze & Aluminum Co., Cleveland, was reelected president. J. E. Pepall, Magnesium Co. of Canada, was reelected vice-president, and P. B. Craighead, Magnesium Products of Milwaukee was elected a vice-president. James V. Cosman, Superior Bearing Bronze Co., Woodridge, N. J., was reelected treasurer.

Named as directors for the coming year were: S. E. Bohn, Howard Foundry Co.; Wiser Brown, Aluminum Co. of America; E. S. Christiansen, Magnesium Co. of America; P. B. Craighead, Magnesium Products of Milwaukee; A. Christello, American Light Alloys, Inc.; J. D. Hanawalt, Dow Chemical Co.; J. B. Heisler, A. C. Williams Co.; C. E. Larson, White Metal Rolling & Stamping Co.; W. H. Osborne, Acme Aluminum Foundry Co.; J. E. Pepall, Magnesium Co. of Canada Ltd.; E. H. Perkins, Brooks & Perkins, Inc.; R. D. Taylor, Federated Metals Div., American Smelting and Refining Co.; and John Thomson, Dominion Magnesium Ltd.

Continuing as executive secretary is Jerry Singleton.

Film Shows Shell Mold

A four station shell molding machine, sand and resin conveying equipment and a four-station shell closing machine are portrayed in a 15 minute, sound and color motion picture.

This film of an actual, operation production set-up is available, without charge, to interested parties. Write: Link-Belt Co., Prudential Plaza, Chicago 1, Ill.

It's easy to obtain product data with the postage-free Reader Service Cards provided on pages 13-14. Use them for information on advertised products, too. Just circle the key number appearing at bottom of the ad.

talk of the industry

EXPENDABLE PATTERNS have been used ever since the cire perdue process was devised centuries ago, but the practice has always been to melt or dissolve the pattern out of the cavity before filling with molten metal. Now a patent is pending on a technique that leaves the expanded polystyrene pattern in the mold to be burned out by the metal as it pours into the mold. Castings produced to date are rough but technique might have application in experimental work since patterns can be cut out of blocks of expanded polystyrene or assembled by cementing together portions of standard shapes.

WITH INGOTS ALMOST WORTH THEIR WEIGHT IN GOLD non-ferrous foundrymen will be interested in a system adopted by Bud Egetter, Crown Brass Mfg. Co. Ingot is identified as received by means of metal stamp which simplifies tracing in case of theft.

CAN'T CONVINCE MANAGEMENT you need a piece of equipment or a process change? Take a weekend or one-night-a-week selling job to learn successful selling techniques is the suggestion of one foundryman who attended the Industrial Engineering luncheon during the recent AFS Castings Congress.

ASIDE TO CASTINGS USERS . . show the casting weight on the blueprint so bids will be comparable, it was said during the discussion of purchasing practices sponsored by the Non-Ferrous Founders' Society and the American Foundrymen's Society at the recent AFS Castings Congress. If you don't know how to figure weights, see the Foundry Facts data sheets in MODERN CASTINGS, October 1955, page 71, and November 1955, page 69.

DO YOUR CUSTOMERS KNOW what your product looks like under a microscope? Experience of one pearlitic malleable producer indicates that this might well be a fruitful field for customer education. Seems a customer was ready to ship back a huge order because the microstructure was not lamellar as he thought pearlitic should be. He was not familiar with spheroidized pearlitic malleable.

Herbert E. Coobe

let's get personal

Electro Metallurgical Co., a division of Union Carbide and Carbon Corp., has consolidated its metallurgical services in a new Metallurgical Service Division. **H. P. Rassbach** will head the division and **R. A. Clark** will be foundry service manager. New office will be 1300 Lakeside Ave., Cleveland.

Thomas R. Wiltse . . manufacturing superintendent of the Saginaw Malleable Iron Plant, Central Foundry Division, General Motors Corp., has been selected to spend 12 months studying as a Sloan Fellow in the Executive Development Program at Massachusetts Institute of Technology. **Arthur J. Karam,** now at the division's Defiance plant, will replace Wiltse at Saginaw.

Martin J. O'Brien, Jr. . . has been named manager-manufacturing engineering for General Electric Co.'s foundries in Everett and Lynn, Mass. O'Brien is a past director of AFS and a member of four AFS technical committees.

C. R. Welles . . has been named sales manager for Hanna Furnace Corp., merchant pig iron division of National Steel Corp.

W. Cordes Snyder, Jr. . . president of Blaw-Knox has been presented one of eight 1956 Horatio Alger awards in recognition of his advance from molder's helper at Wheeling Mold & Foundry Co. to president of Lewis Foundry to President of Blaw-Knox.

Herbert H. Fairfield . . has been named chief metallurgist for Los Angeles Steel Casting Co. Recently a metallurgist in Sheffield, England, he spent two years as associate professor at American University, Beirut, Lebanon, after leaving Wm. Kennedy & Sons, Owen Sound, Ont.

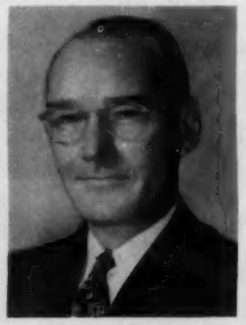
J. H. Bertrand . . has joined Lester B. Knight & Associates, Inc., Chicago, as manager of plant engineering.

Clyde L. Pinkston . . has joined the Foundry Educational Foundation as field director to maintain liaison between the organization and the castings industry.

Matthew J. Donachie . . has resigned as president of the Beryllium Corp. to concentrate on his efforts as director of research and development. **Walter R. Lowry** becomes president of the company.

New vice-presidents elected by Keokuk Electro-Metals Co., Keokuk, Iowa, are **W. T. McGinnis** and **Donald F. Brookland.**

Charles W. Glunk . . has been appointed chief ceramic engineer of A. P. Green Fire Brick Co., Ltd., in Toronto. He moves from firm's Richmond,



H. P. Rassbach

R. A. Clark

M. J. O'Brien, Jr.

Va., office where **Charles G. Perry** will be his replacement.

Arthur Zrimsek . . has been appointed foundry sand engineer for Magnet Cove Barium Corp., Houston, Tex.

Harry C. Ahl . . has moved from American Brake Shoe Co., National

Harry C. Ahl

Bearing Div., to new post as technical director, Samuel Greenfield Co., Inc., Buffalo, N. Y.

F. S. Jones . . castings buyer for Tractor and Implement Division, Ford Motor Co., has been promoted to purchasing agent in charge of the assembly purchasing department.

Harold Warner . . vice-president in charge of foundry, Berlin-Chapman Co., Berlin, Wis., has been appointed to the Administrative Council of the National Foundry Association.

Richard C. Meloy . . joined the executive staff of Gray Iron Founders' Society, Inc., Cleveland, June 1 as

R. C. Meloy

marketing director. Meloy formerly headed market research for Delco division of General Motors.

Fred P. Biggs and George E. Anne . . chairman and vice-president respectively, of the Brake Shoe and Castings division of American Brake Shoe Co., retired from the company April 30

after a combined total of 71 years of service.

Jack R. DeBacher . . has been elected a full vice-president of Thor Power Tool Co., Aurora, Ill. He was previously executive vice-president of the company's SpeedWay Mfg. division.

J. E. Rehder

J. E. Rehder . . has been named vice-president-technology for Canada Iron Foundries, Ltd., Montreal, Que. He was previously director of technology and research.

Dr. Robert K. Smith . . has been appointed manager of research for E. F. Houghton & Co., Philadelphia.

Leslie V. Whiton . . non-ferrous marketing and production consultant has opened an office at White Plains, N. Y.

Henton Morrogh . . British Cast Iron Research Association researcher has been awarded the Sir Robert Hadfield Medal of the Iron and Steel In-

H. Morrogh

stitute (British) for his study of the metallography of cast iron and for researches resulting in the discovery of nodular iron. In 1952 Morrogh received the Wm. H. McFadden Gold Medal from AFS.

Dr. Robert J. Anderson . . has resigned as head, department of metallurgy, Southwest Research Institute,

San Antonio, Tex., to join Diamond Metal Co., Inc., Houston, Tex.

John D. Smith, William A. Gray III, and Harold J. McCallum have new posts with George F. Pettinos, Inc. Smith and Gray are now sales representatives and McCallum will be a sales service representative.

R. E. Jordan

Roy E. Jordan . . has resigned as foundry superintendent, F. E. Myers & Bro. Co., to join the Kennedy Valve Mfg. Co., Elmira, N. Y., as superintendent of the foundry division.

Peninsular Grinding Wheel recently named new posts for **H. D. Murray** and **F. R. Old.** Murray will be eastern sales manager, with Cleveland headquarters, while Old becomes western sales manager with a Detroit address.

Edward C. Hanus . . has resumed duties as personnel manager of the Osborn Mfg. Co. after completing a

E. C. Hanus

management diversification program designed to give key executives experience in major phases of company operations.

Joseph F. Sullivan, Jr. . . has been named plant manager of Utilex Mfg. Co., Fowlerville, Mich., die casting plant.

Sterling Grinding Wheel Co. announced promotion of **W. F. Schlich** and **James L. Goodwin** to regional sales managerial posts. Schlick will

headquarter in Chicago and Goodwin will headquarter in Cleveland.

Edwin J. Worth . . has been named sales engineer for foundry facing materials by Black Products Co. He will headquarter at the firm's Fontana, California, plant.

C. Crawford

Clair Crawford . . has been named as general sales manager, Thiem Products, Inc., Milwaukee.

Jack E. Fathauer . . has been named sales manager, railway division, for the Cleveland office of National Malleable and Steel Castings Co.

Wallis W. Wood . . has been appointed manager of Bohn Aluminum & Brass Corp. plant in Greensburg, Ind. Plant produces bearings and bushings.

Joseph L. Lessman . . has been promoted to plant manager, foundry division, Cooper Alloy Corp., Hillside, N. J.

Robert R. Freeman . . has been named manager of arc-cast molybdenum development for Climax Molybdenum Co.

E. J. Vargo

Edward J. Vargo . . has been named plant manager of the Alloy Precision Castings Co., Cleveland.

George W. Andre . . is now representing Ironton Fire Brick Co. in Florida, Georgia, and South Carolina.

pouring off the heat

down to brass tacks

■ Congratulations to AFS on the establishment of the Fundamental Papers Committee! It is good that the Society is awaking to the fact that fundamentals, not rule of thumb, is what the industry needs. I'd like to take this opportunity to wish the new committee every success and to express the hope that it will deal in exactly what its name signifies—fundamentals—and the correlation of fundamental phenomena relating to all types of metal casting.

N. F. HINDLE, *Head*
Mechanical Engineering Dept.
University of Idaho

Success of the Fundamental Papers Committee can be judged by the fact that some 200 foundrymen attended the single session sponsored by the committee at the recent AFS Castings Congress. The idea was developed by Prof. Howard F. Taylor of Massachusetts Institute of Technology who is committee chairman. Future growth and development of Fundamental Papers Committee activities along the lines hoped for by Prof. Hindle, a former technical director of AFS, seems assured.—EDITOR.

good for other industries too

■ Just received my copy of the new ENGINEERING MANUAL FOR CONTROL OF IN-PLANT ENVIRONMENT IN FOUNDRIES recently issued by AFS. I think it is one of the most outstanding jobs of compiling an industry handbook on health and safety that I have seen. It will have much wider application than just the castings industry. We have found several good features that we can use here.

KARL L. DUNN, *Manager*
Safety & Industrial Hygiene
Corning Glass Works

to get all the facts

■ The May 1956 issue of MODERN CASTINGS contained an article entitled "*Don't Throw $$$ Away in the Furnace.*" As you pointed out at the end of the article, it was excerpted by your editors from my paper "*Use of Pig Iron in Iron Foundries*" which was presented at the AFS Castings Congress in Atlantic City.

Through a mix-up somewhere along the line, your article was based on a

preliminary rough draft of the original paper, and for this reason does not accurately reflect the information in the original paper as finally submitted for publication.

It is suggested that readers interested in this subject refer to Preprint 56-28 (will later appear in the 1956 bound volume of AFS TRANSACTIONS) for the entire final version of the paper.

H. W. LOWNIE, JR., *Chief*
Process Metallurgy Research
Battelle Memorial Institute

doubt project is feasible

■ The supply of Lake Michigan sands that are suitable for use in cores is vastly greater than the demand for core sand. Also, Lake Michigan sands are not competitive with Ottawa sand, either for use in molding or in glass manufacture. If a large portion of the non-quartz components of Lake Michigan sand can be removed without prohibitive cost, then the silica-enriched residue may be able to find applications and markets for which the original, unbeneficiated sand cannot qualify.

It is my understanding that a good glass and of high purity and silica content is superior to Lake Michigan sand for use in molding. Thus, Ottawa sand is superior to Lake Michigan sand for molding, although the latter is better than the former for use in cores. Correct me if I'm wrong.

OHIO BUSINESS MAN

It is true that a good glass sand of high purity and silica content is superior to Michigan dune or lake sand for molding, and it is even more true for coremaking. The superiority rating would be based on refractoriness of the raw sand alone. In the case of molding, the sand would have to be compounded (preferred by the AFS Sand Division to "synthetic") since it would contain no natural binders.

Michigan dune or lake sand is not quite as pure as Ottawa sand, therefore the former theoretically will be inferior to the latter in any steel application, whether molding or coremaking. Nevertheless the Michigan dune or lake sands are widely used in malleable and gray iron shops and Michigan silica sand is used for steel foundry cores.

It's hard to beat Ottawa sand (actually St. Peter sandstone that is found all over the Mississippi River valley from Minnesota to Arkansas) for cores, compounded molding sand, and glass. Many foundrymen use it and it is used in glass making at the Ford Motor Co. plant in St. Paul,

Minn. Ottawa sand is extremely pure —99.89 per cent silica—and is well graded which, with its rounded grains, makes it ideal for foundry use. However, there are other excellent deposits of similar sands elsewhere in the country which are also used if cost (primarily freight) makes it advantageous to do so and if the sand is a reasonably acceptable substitute for Ottawa sand.

Some Michigan silica sands are almost as pure as Ottawa, running 98.63 per cent silica after washing to remove a calcium coating. Dried and screened, these sands produce good steel foundry cores and could also be used for compounded molding sands. Anything that will stand up to the high temperatures of steel will also serve in any other foundry although it would be possible to purchase an adequate sand at lower cost where refractory requirements are lower.

Michigan, also Indiana, dune or lake sands found along the south and east shores of Lake Michigan are used extensively for malleable and gray iron cores. They are high in silica. One sand used to be pumped up from Saginaw Bay and may still be. This sand had good particle size distribution but contained about 0.60 per cent lime which many foundrymen do not like.

Michigan bank sands are found inland. There's a particularly good, large deposit near Vassar. These sands are used for non-ferrous cores (lower refractories can be tolerated) and to increase the green strength of core mixtures for ferrous castings. Bank sands run only about 90 per cent silica and it may be that you are referring to these sands in considering beneficiation.

Unless you have a superior, low cost method or have some freight rate advantage, we do not believe beneficiation (other than grading and perhaps washing) would be economically feasible—EDITOR.

MOST NEGLECTED PHASES

You don't need trick techniques if you take advantage of fundamentals

W. R. JAESCHKE / *Cons. Met. Eng.*
Whiting Corp.
Harvey, Ill.

■ While the cupola is the oldest and most popular melting furnace in use in iron foundries, constantly changing personnel and the introduction of new ideas require frequent review of fundamentals. The conventional cupola is a "blind" type of melting furnace—that is, there are no openings through which to watch the actual melting. Because of its blind nature, there has been much discussion about what actually goes on inside.

In one classic investigation[1] a 36-in. shell diameter cupola was used. It was 7 ft. 11½ in. high from bottom plate to charging opening sill, lined to a 27-in. inside diameter. The cupola was equipped with four flared type tuyeres with an area equal to 16.7 per cent of the cupola area. Blast was delivered by a positive displacement type blower, with a blast rate reported at 1013 cfm. (Both the tuyere area and the blast rate are slightly less than present-day recommendations.)

Only coke was charged into this cupola, there being no attempt made to melt iron. The coke was reportedly three-inch cube and less in size. Gas samples were taken at various points in the coke bed and just below the charging opening sill. The results of the gas analyses are graphically shown in Fig. 1. This figure is actually two half-section sketches of the cupola. The section on the right is that of the first test, conducted in the straight wall cupola; the section on the left is that of a test conducted in the cupola with the lining boshed from 27 in. to 23 in. inside diameter just above the tuyeres.

Gas samples were taken at the points of intersection of the light horizontal and vertical lines at distances from the top of the tuyeres and in from the cupola wall as indicated by the dimensions. The actual analyses are shown at these points, the top figure being per cent by volume of carbon dioxide, the middle figure oxygen, and the bottom figure carbon monoxide.

A dotted line shows points at which the gas analyses indicated complete combustion. This line forms the proverbial "inverted cone" so often referred to in cupola discussions. The analyses confirm the theory that carbon is first burned to carbon dioxide, and that some of the carbon dioxide is then reduced by the incandescent coke to carbon monoxide. The first reaction is relatively rapid and produces heat; the second reaction, fortunately, is slower but consumes heat.

High-temperature thermocouples recorded only 1576 F at the tuyeres. At the center of the cupola, where combustion was complete, they went up to 3100 F and then failed.

The zone inward from the line of completed combustion is a reducing zone where some of the carbon dioxide is reduced to the monoxide, a reducing gas. Some heat is consumed in this process, but the monoxide generated protects the metal charge from excessive oxidation during preheating and melting.

The zone between the line of complete combustion and the tuyeres is the combustion zone, and it has an oxidizing nature. All the metal should be completely melted before it reaches this zone, and such is usually the case when the coke bed is prepared originally to a level above the top of the inverted cone and when subsequent coke charges are heavy enough to maintain the bed at that level.

Some oxidation of the metal is unavoidable when, in the molten state, it passes through the oxidizing combustion zone. This oxidation of molten metal is responsible for much of the loss of lining that occurs there.

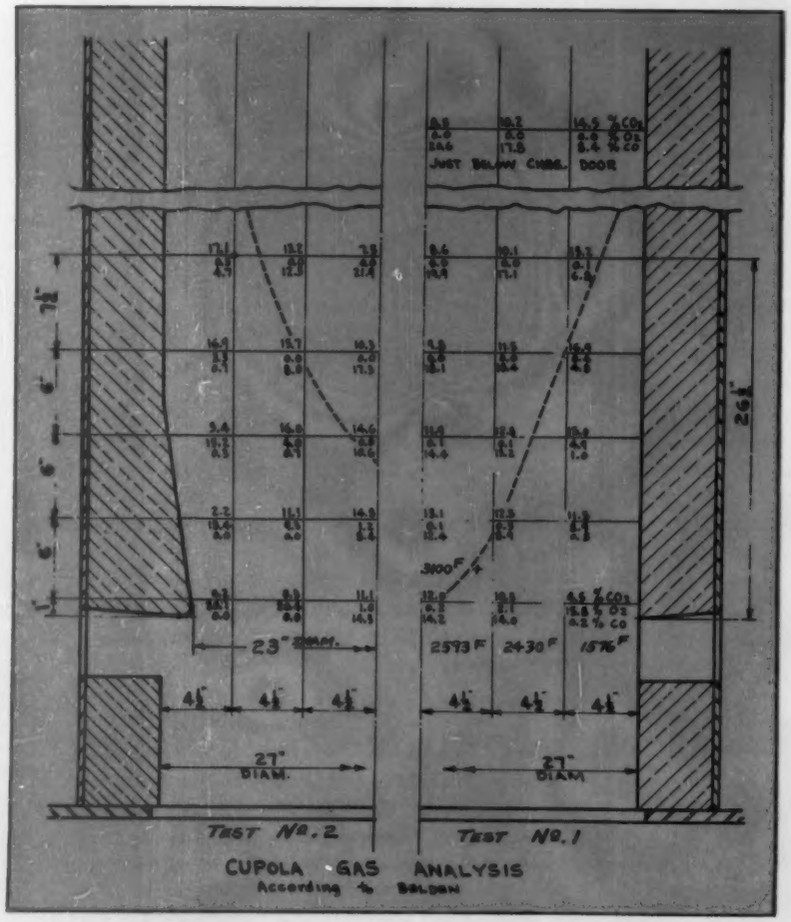


Fig. 1 . . Cupola combustion conditions indicated by analysis of gasses.

OF CUPOLA OPERATION

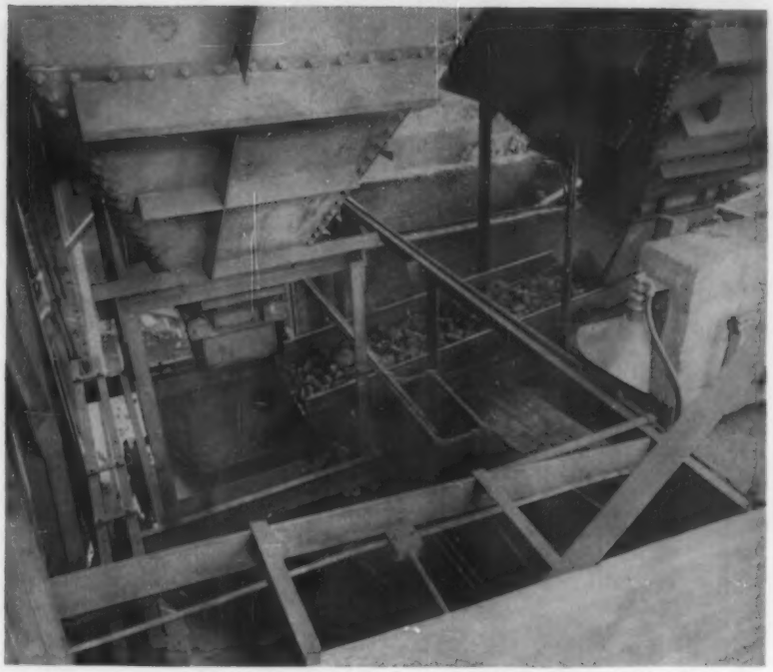


Fig. 2 . . Vibrating coke feeder is arranged for screening out fines.

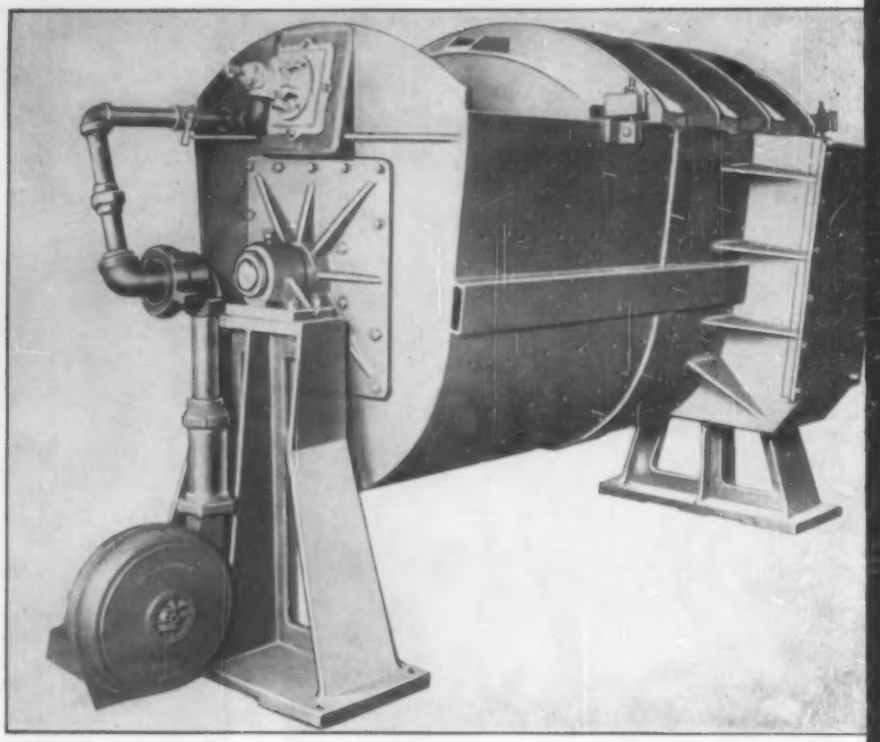
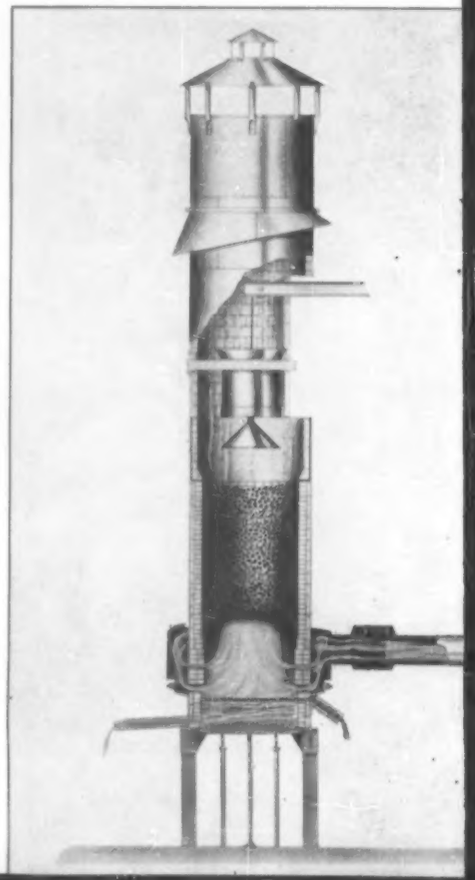


Fig. 3 . . U-type mixing and desulphurizing ladle preheated by oil burner.

Fig. 4 . . Cone bottom bucket with crane type charger.



Size and shape of the combustion zone are influenced by many factors such as lining contour; blast volume, velocity, temperature, moisture content and oxygen content; coke size and burning characteristics; and size and distribution of the melting stock. The ideal combustion zone would be a uniform, shallow, horizontal section. Under these conditions, combustion and melting would proceed at a uniform rate over the entire cross-section of the cupola. This would give maximum metal temperature, maximum melting rate, and minimum sulphur pickup.

As the blast rate is increased, the position of the inverted cone is raised. A higher coke bed should be used. Even with a higher coke bed there will be some increase in oxidation because more molten metal will drop through the larger oxidizing combustion zone at the tuyeres. Conversely, lower blast rate, higher blast temperature, lower moisture content and higher oxygen content of the blast reduce the size of the combustion zone and produce less oxidation.

The half-section sketch on the left of Fig. 1 shows the increased penetration of the blast resulting from a boshed lining. The conclusion originally drawn from the test was that this did not improve combustion. While this seems sound for a 27-in. cupola in which no iron was melted and no flux used, it is evident that the bosh would be effective in cupolas of larger diameters. Further, if iron and flux charges had been used in the tests for a reasonable length of time, it would have become evident that the boshed lining helps maintain cleaner tuyeres.

Coke Size Is Important

Large coke creates little resistance to the blast. With good penetration of blast into the coke bed, the inverted cone is less deep. Large coke also retards the rate at which carbon dioxide is reduced to carbon monoxide, creating a deeper, hotter superheating zone for melting to higher tapping temperatures.

Small coke, on the other hand, presents considerable resistance to the blast and creates a deep inverted cone. Most melting is then done in a narrow outer ring, and more carbon monoxide is produced in the larger reducing zone in the center. The superheating zone is not so deep, more coke is spent in forming monoxide, and more coke is then needed to melt and superheat the iron to the desired tapping temperature.

For best overall results, the coke size should be proportionate to the inside diameter of the cupola.[2] Coke averaging about ten per cent of the cupola ID has been found to give optimum results. In hand charging operations, coke should be forked to reject undersize

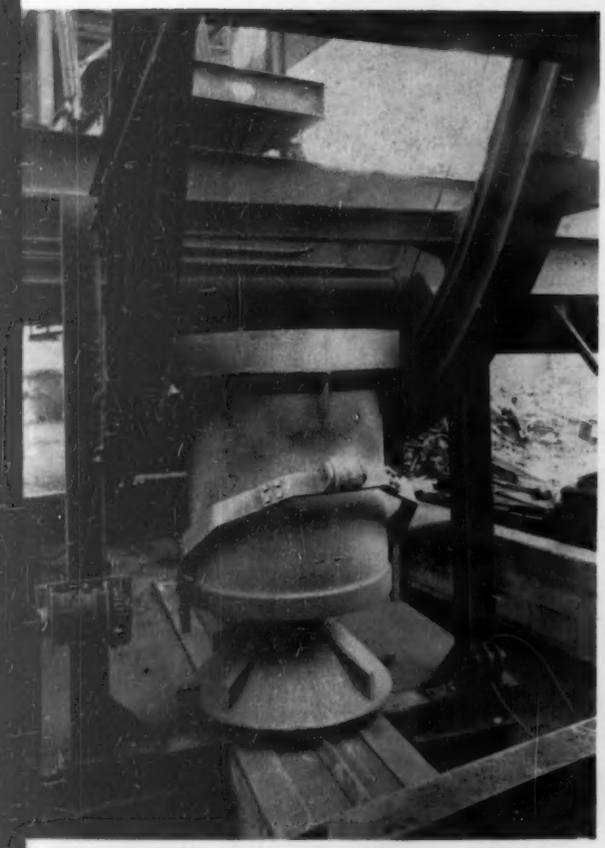


Fig. 5 . . Skip charger with a cone bottom bucket.

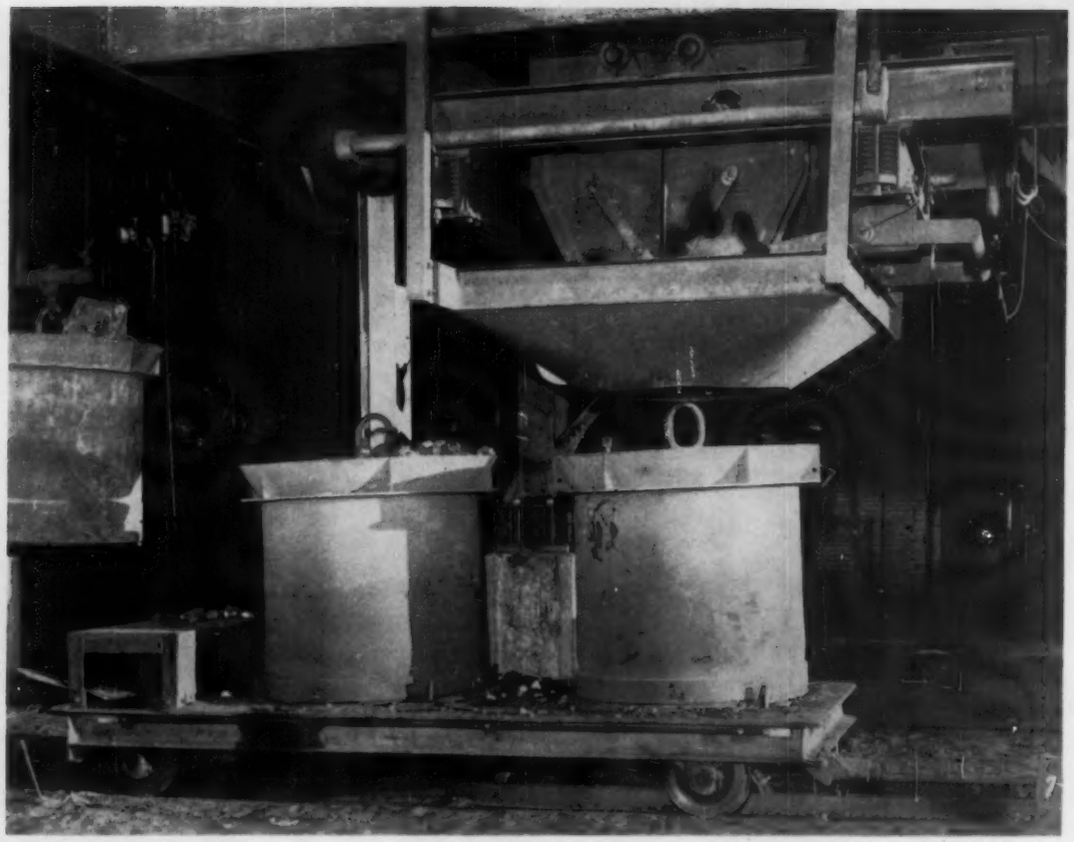


Fig. 6 . . Weigh hopper loaded by electromagnet on crane drops charge directly into cone bottom bucket.

pieces. In mechanized charge make-up installations, vibratory screens for feeding coke to the weigh hopper effectively keep small coke out.

Cupola melting coke should be of high heat value. It should be strong enough as received to permit a reasonable amount of handling, and strong enough at high temperatures to support the cupola burden under operating conditions. It should be readily combustible by air but not too reactive with carbon monoxide. It should be low in sulphur, preferably under 0.8 per cent.

Coke is frequently required to provide an appreciable portion of the carbon in the iron as tapped, and then its reactivity with molten iron is also an important factor. The lowest fuel costs and highest melting rates are possible when the charge requires no carbon from the coke; the cupola is then operating at maximum thermal efficiency. Under some market conditions, however, it is possible to save metal costs by using more scrap and less pig iron in the charge. In this case, extra coke or special carbon raisers will be needed to carburize the extra portion of scrap iron.

Scrap Iron Is Tricky

When scrap iron is used in place of pig iron, it must be remembered that pig iron is more uniform in composition, size, cleanliness, and absence of contaminants. Attention should be given to adequate mixing ladle facilities to level off the greater variations in metal composition and temperature likely to result.

Mixing and desulphurizing can be done in a U-type ladle, but some temperature loss will be incurred.[3] This loss will be proportionate to the length of time the iron is held in the mixer. Larger than normal mixers may be used if they are fuel fired or electrically heated.

Scrap iron also varies in bulk, and large scrap is apt to arch or hang up in the cupola rather than descend at a uniform rate. The coke in the bed is consumed at a fixed rate by the constant rate of blast; it should be replenished at the same rate by the coke charges that come down as the iron is melted.

Any arching or hang-up retards the gravity flow of coke to the combustion zone, while the bed burns to below its usual level. When the slag becomes darker, when metal temperature drops, when fracture tests indicate harder iron, the operator becomes aware that the coke bed is too low. He adds a booster charge of coke and perhaps reduces the blast rate until the booster coke reaches the bed.

If these hang-ups occur frequently, the operator will further guard against excessive oxidation by adding appreciable amounts of "safety" coke to the regular coke charges. While serious operating troubles may be avoided by these measures, the melting rate will be reduced and there will continue to be variations in the metal as tapped.

To avoid arching, all metallics should be reduced to reasonable size proportional to the size of the cupola. The maximum dimension of any piece of scrap in the charge should not exceed 30 per cent of the cupola's inside diameter.[4]

Extremely small scrap such as punchings or extremely heavy scrap such as sugar mill roll shafts may drop into the combustion zone before they are completely melted. This causes excessive oxidation troubles similar to those that result from melting with a coke bed that is too low. Extremely thin materials like loose sheet metal trimmings

also oxidize too much, and should be pressed into bundles or rejected.[5]

Broken light cast iron scrap is high in ratio of surface area to mass and has a rapid rate of heat transfer. Since the melting point of cast scrap iron is low, light cast iron scrap can be melted more efficiently than heavy materials such as ingot mold scrap or steel shafting. For the best overall results a scrap should approximate the section size of the castings being produced. The charges throughout a heat and from heat to heat should be as nearly alike physically as well as chemically for the greatest uniformity in the product.[6]

Charging and the Cone

The shape of the inverted cone can be influenced by charging practice. In the days of hand charging the old masters recommended that the heaviest stock be distributed around the cupola at the lining, with only light open stock in the center. Coke and limestone were to be spread over the whole charge. The purpose of this selective distribution was to create greater density of the charge at the lining and less density at the center to counteract the tendency of the blast and hot gases to channel up along the lining instead of through the bulk of the charge.

Mechanically, this variation of density in the charged column is possible only when charging from a uniformly loaded cone bottom bucket. This manner of distribution will give better blast penetration, more uniform combustion and melting over the whole cross section of the cupola. The result is maximum metal temperature, maximum melting rate, minimum oxidation, and minimum sulphur increase in the metal.[5] The charge should be dropped vertically into the bucket for uniform loading; chute loading is no more satisfactory for loading a cone bottom bucket than for charging a cupola. Cone bottom buckets are the slow release type. The charge is practically dribbled into the cupola with a minimum of impact.

Other types of buckets tend to drop the charge in humps. From chute chargers the hump is most likely to be on the side opposite the charging opening. Some segregation of the material also results from this manner of charging, particularly of limestone. Limestone, however, is most likely to channel down directly under the charging opening, scouring the lining deeply on this side while the tuyeres on the opposite side bridge heavily. The blast and hot gases naturally channel up the clean open section.

Drop bottom buckets of the quick release type drop the charge densely in an inner ring of the cupola with considerable impact. The charged column is dense in the center and loose and permeable at the lining. Consequently the blast and hot gases channel up along the lining. Most of the melting is done in a narrow outer ring.

Drop bottom buckets of the slow release type drop the charges in one or two dense humps, depending on whether the bottom halves are hinged on the outside or along a center line. The blast and hot gases then seek the loosely packed valleys, and melting follows the same pattern.

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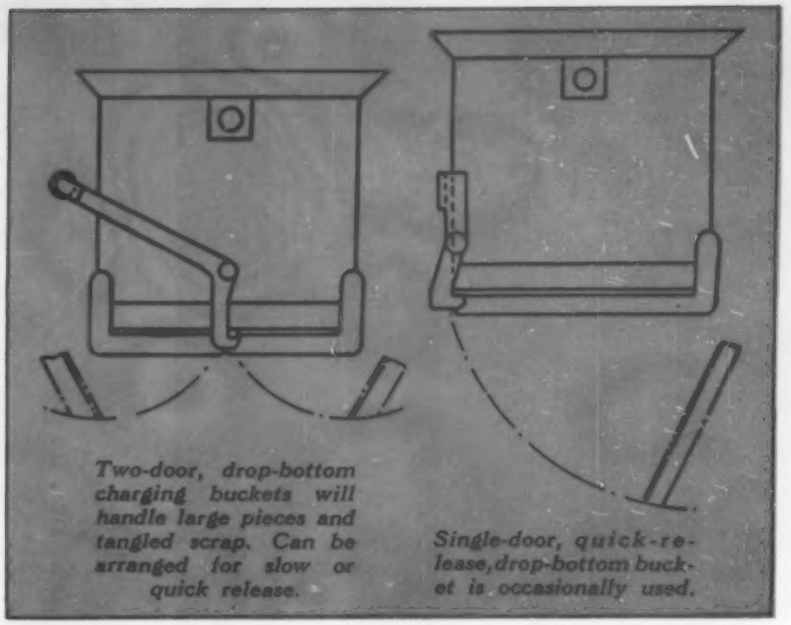


Fig. 7 . . Operation of two types of drop bottom charging buckets.

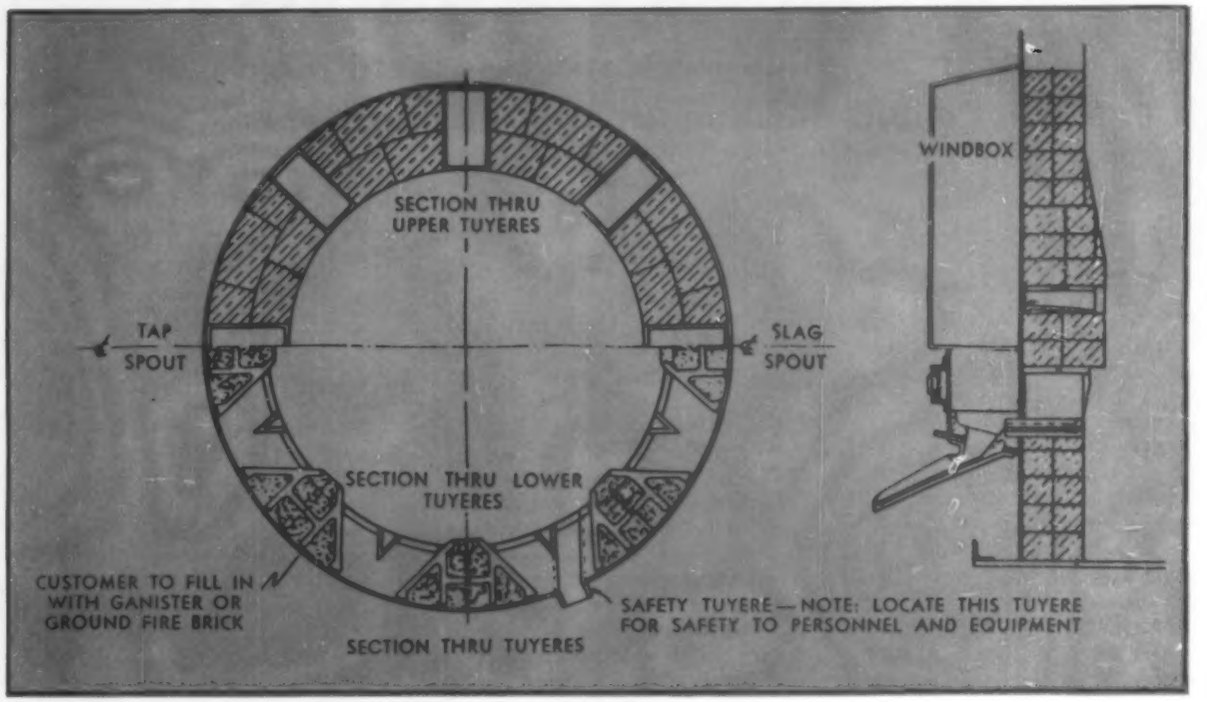
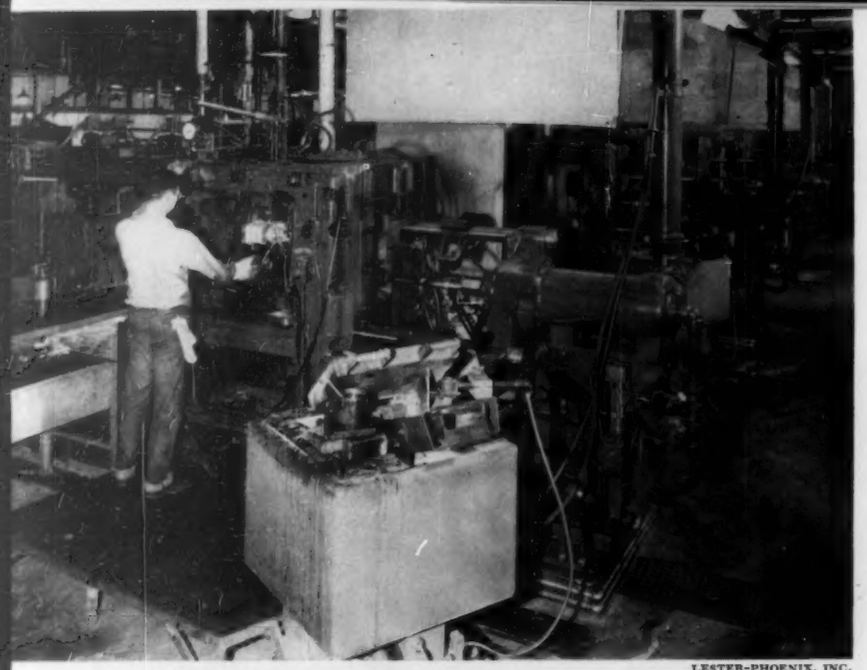


Fig. 8 . . Two rows of staggered tuyeres are sometimes used to minimize bridging encountered with cold blast.



LESTER-PHOENIX, INC.

ONCE THERE WAS A HARD SPOT in an ALUMINUM DIE CASTING

Why minimize machining by casting in a metal mold if you don't avoid finish machining headaches?

DONALD L. COLWELL
Director of Laboratories
Apex Smelting Co.

OLDRICH TICHY
Chief Metallurgist
Apex Smelting Co.

■ Machining of die castings, particularly in the drilling and tapping of holes and the facing of certain surfaces, is of much greater importance now that die castings have achieved a prominent place as an engineering material. This discussion is limited to some of the difficulties occurring in machining operations for which the die casting itself is responsible, and methods for the prevention of these difficulties will be presented.

The composition of the aluminum alloy used has a bearing on the machinability of a die casting. The most commonly used alloy contains 9 per cent silicon and 3½ per cent copper basically, although the copper may be lower and the silicon higher in certain cases. A typical ingot composition, for this alloy ASTM SC84A, is shown on Table 1.

Silicon is added for castability, as many of the intricate shapes which are common today could not be cast without it. Unfortunately it adversely affects machinability.

Copper increases hardness and strength and particularly increases yield strength. Copper also improves machinability.

Other elements which have an effect on machinability are iron, magnesium, manganese and zinc. An iron content of about 1 per cent and a manganese content of about 0.4 per cent are highly desirable from a castability standpoint. They greatly reduce the tendency of the alloy to solder or weld to the die and they improve castability. In these quantities, they tend to improve machinability by providing higher hardness, although if the metal is not handled properly, they have a secondary effect which will be discussed below.

Magnesium in the silicon-copper alloys is present only as an impurity and because of its age-hardening effect, should be limited to less than 0.10 per cent. It is also undesirable from a casting standpoint, although larger quantities of magnesium would help machinability.

Zinc is now recognized as a desirable alloying element. The greatest beneficial effect of zinc in the alloy is improved machinability, and in many instances, a difficult machining problem has been eliminated by the addition of 2 or 2½ per cent zinc to this type of alloy rather than by limiting it to the 1 per cent more commonly specified.[1]

Because of the beneficial effects of zinc on machinability, tests of the American Society for Testing Materials now in progress indicate that the corrosion resistance of SC84A is not impaired by higher zinc contents. Exposure of test bars of this alloy with varying zinc contents at three locations (New York, Kure Beach, N.C., 800 feet from the ocean and Kure Beach, N.C., 80 feet from the ocean) have proved that after one year's time, zinc contents up to 2 per cent and higher had no effect.

These results are summarized in Fig. 1,[2] where it can be seen that the tensile strength is not affected by outdoor exposure in New York but is reduced by both Kure Beach exposures and by approximately the same amounts with both low and high zinc contents. The same is true of the elongation for all zinc contents, with a slight hardening effect at New York. The yield strength at any of these zinc contents has not been affected by corrosion at these locations.

Serious porosity of die castings has been largely eliminated as a result of the newer types of machine and the increased skill of the die caster in gating and venting. If porosity does occur, however, at an area to be machined, it can cause difficulty with tool wear and with breakage of drills and taps. The latter is particularly troublesome when a lug or boss has to be drilled and tapped in a small size and the drills run into porous areas with resulting bending and breaking.

Proper gating and venting of the die to eliminate trapped air can often clean up troublesome porous areas. Gases other than air can cause the same difficulty, and it seems that gases due to the volatilization of the lubricant used in the die are more often at fault than air. In order to obtain solid castings, a die should be operated with a minimum of lubrication.

Castings showing porous areas using radiographic examination, will often be contaminated with oil. Sometimes the amount of oil or lubricant trapped in the casting is so great as to be plainly visable when the casting is sectioned. Such an area is shown in Fig. 2, where the porosity is not excessive but oil exudation is plainly visible at the upper left. In this particular casting, the amount of lubricant used was so great that the surface of the casting was discolored in places.

One of the more frequent troubles with machinability of die castings and strangely enough, the one

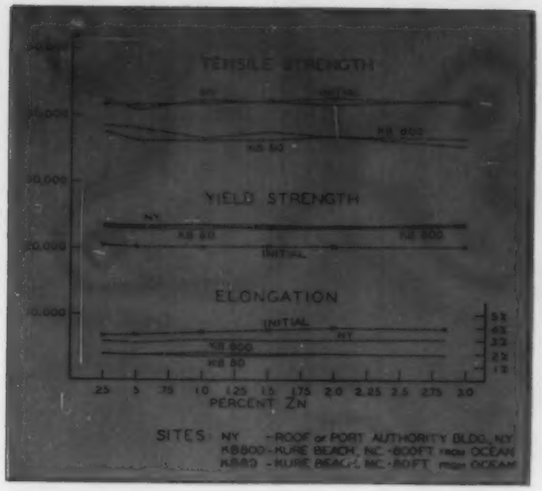


Fig. 1 . . Effect of zinc on corrosion resistance.

Fig. 2 . . Oil seepage in die casting.

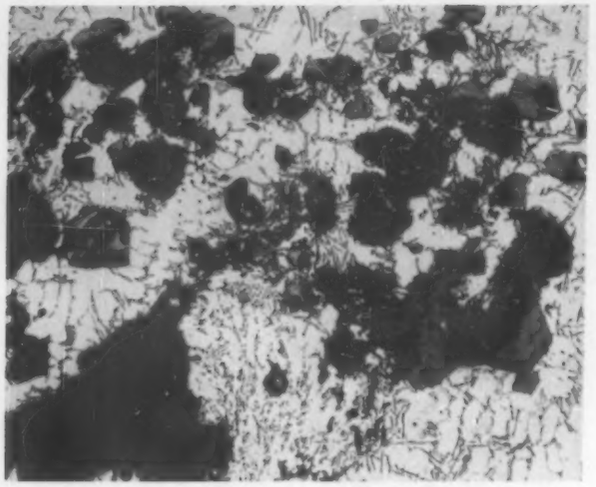


Fig. 3 . . Fused Al_2O_3 (black) and AlFeSiMn (gray). 75X.

which is probably the easiest to control, is one due to the presence of non-metallic inclusions or hard spots. These inclusions, when small and finely divided, act as an abrasive and cause excessive tool wear. In the worst cases, sometimes, chunks plainly visible to the naked eye are occluded in the castings and are hard enough to nick and break the cutting tool. The black areas of the micrograph shown in Fig. 3 at 75X are examples of this type of inclusion.

Aluminum, either solid or molten, is covered with an oxide skin, and this skin forms so rapidly in the molten condition, that it builds up into a surface dross. This build-up is faster if the metal is agitated by new charges, by stirring or by dipping out. The oxides are fairly soft when newly formed, but when they collect on the sides of the furnaces or pots and are exposed to high heat, and in many instances, direct flames, they are converted into an extremely hard form of aluminum oxide and are comparable to the fused aluminum oxide abrasive known as alundum.

Some of these oxides have about the same density as the molten aluminum, consequently, they are often suspended in the aluminum in more or less finely divided form and are transferred to the casting. The result is a soft aluminum casting carrying imbedded particles of an abrasive, and this acts as a grinding wheel in destroying the tool. Furthermore, if a chunk of the fused oxides which has formed on the wall of the furnace or the pot is chipped off and gets into the casting, it can be exposed at a surface to be machined and can nick and break steel, tungsten carbide or diamond tools.

The aluminum oxide type of hard spot can be avoided by good housekeeping. Furnaces, pots, ladles and skimmers must all be kept clean. Slag buildups on the furnace walls and on the sides of the pot must be scraped off periodically and removed. It is poor practice to charge scrap directly into the holding pot, as the large surface area from the scrap has a tendency to

Fig. 4 . . Sludge of hard metallic compounds from bottom of pot. 40X.

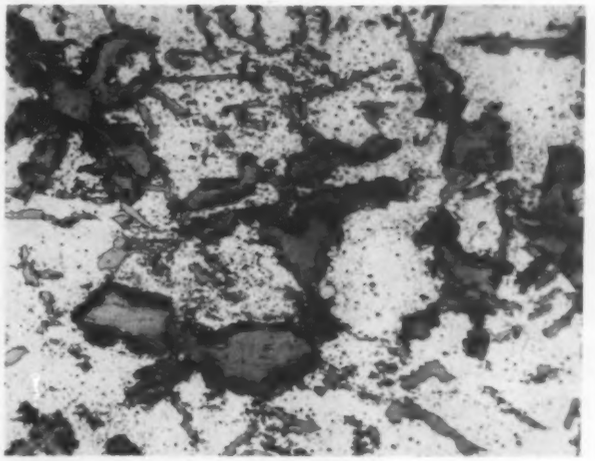
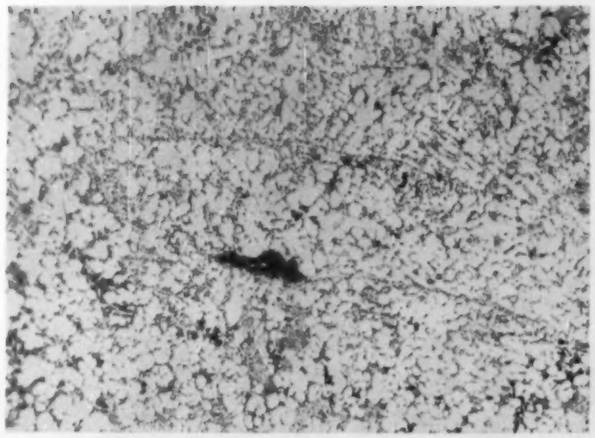


Fig. 5 and 6 . . Oxide around inclusions of AlFeMnSi complex (left) are removed by proper fluxing (right). 250X.



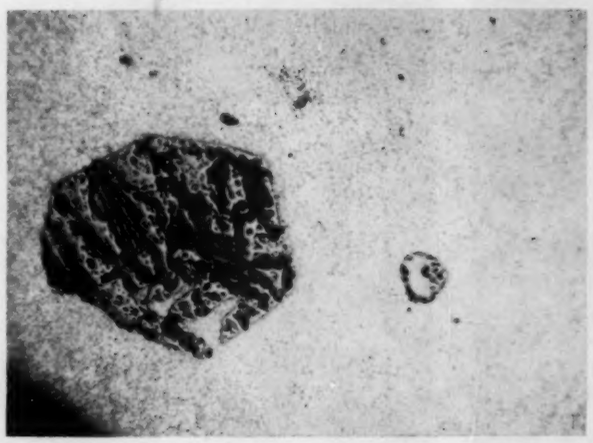


Fig. 7 and 8 . . Normal SC84A cast structure (left) at 150X. Right, large chunk of hard complex trapped in casting. 40X.

make more oxide and thus greatly increases the chances of such oxide inclusion.

Both scrap and ingot should be melted in a preliminary melting furnace and heated to about 1300 to 1400 F, depending on the temperature drop in transferring to the holding pot, and then thoroughly mixed and fluxed and skimmed. The skimming must be done completely and carefully, and enough flux used to separate the metal from the non-metallics which are then removed as a dry powder. After the skimming is complete, care should be taken not to dislodge any adhering non-metallics from the sides of the furnace or pot.

An entirely different type of hard spot or inclusion and one which often causes the same type of difficulty, is the heavy undissolved metallic segregation which settles in the molten aluminum bath as a sludge and is often carried into the casting. In the alloy referred to above, such sludges are mainly hard metallic compounds of iron and aluminum; iron, silicon and aluminum; and iron, manganese, silicon and aluminum. A section of such a sludge removed from the bottom of a holding furnace is shown in Fig. 4 magnified 40X.

The layers of AlFeMnSi complex are clearly shown and some typical aluminum alloy is occluded in these layers in the lower left hand corner. If this sludge is carried into the casting, the hard inclusions of the AlFeMnSi compounds are entrapped as shown in the photomicrographs at 250X in Fig. 5 and Fig. 6, the latter after good fluxing has cleaned out the oxides. It happens that these two examples are of chill-cast sections, but they illustrate the formation and relative sizes of the metallic compounds.

The photomicrograph shown in Fig. 7 is that of a typical die-cast structure of SC84A alloy at 150X. Note the uniform structure and the finely divided constituents present. In contrast to this structure that of Fig. 8 was made at 40X. The large agglomerate of the undissolved AlFeMnSi complex shown was transferred to this casting from an improperly melted bath. Castings from this lot gave serious machining difficulties.

When sludge accumulates in the holding pot at the die casting machine, it collects on the bottom as a sandy substance and can be dipped out with a skimmer. Its accumulation is most often due to lack of agitation, too low a temperature or both. Sludge accumulation, therefore, can be prevented by adequate mixing and proper temperature control. Its formation can be explained by reference to an oversimplified consideration of the binary system aluminum-iron. The aluminum end of the binary diagram is illustrated in Fig. 9.[3]

In this diagram, iron content is plotted against temperature, and it can be seen that below about 1.8 per cent iron and above 1220 F, the metal is all liquid. With higher iron percentages, the temperature of initial freezing (or liquidus) rises along the slanting line to the right, and between this liquidus and the eutectic temperature of 1211 F, the bath is a mixture of the iron compound $FeAl_3$ and the aluminum bath.

With 5 per cent iron, for instance, at 1300 F the bath would consist of solid $FeAl_3$ in the liquid aluminum, and if allowed to stand at this temperature the $FeAl_3$ would settle and form a sludge. At 2 per cent iron, illustrated by the dotted line, the metal is completely liquid above about 1230 F, and completely solid below 1211 F. Between these two temperatures solid $FeAl_3$ can form and settle out as a sludge.

This explanation is over-simplified as the sludge forming elements are more complex with the presence of silicon, manganese, and sometimes copper, and consequently, the temperature range of sludge formation is wider. The same principle, however, applies.

A frequent practice in the die casting industry often promotes the accumulation of such sludge (Fig. 10). When a molten SC84A alloy is held at about 1200 F and a solid ingot is charged into it, the metal immediately freezes around the ingot and then this and the main body of the ingot slowly melt away. During this process, the temperature range is wide and the number of temperatures infinite, so that all of the high melting point compounds observed in previous figures are freed at sometime during the cycle, and consequently settle to the bottom of the pot as a sludge.

The temperature of the holding pot is never raised high enough nor is sufficient time allowed for complete re-solution to be effected. Preheating of the ingot to 400 or 500 F would have little effect on this phenomenon. The only preheating which would help is pre-

TABLE 1 . . TYPICAL COMPOSITION OF SC84A

Mg	Zn	Mn	Si	Cu	Fe	Ni	Others	Al
0.06	0.80	0.40	9.00	3.50	0.90	0.20	0.40	Balance

TABLE 2 . . EFFECT OF MIXING AND TEMPERATURE ON MELT SEGREGATION

	Mg	Zn	Mn	Si	Cu	Fe	Ni
A (breakdown furnace at 1250 F)							
Top of Bath	0.20	0.96	0.35	9.35	3.45	0.95	0.19
Bottom of Bath	0.07	0.61	2.0	10.10	2.96	5.0	0.64
B (breakdown furnace at 1300 F)							
Top of Bath	0.04	0.87	0.32	8.75	3.38	0.90	0.22
Bottom of Bath	0.04	0.83	0.33	8.50	3.33	0.87	0.23

TABLE 3 . . SEGREGATION AT ADEQUATE TEMPERATURE WITH ADEQUATE MIXING

	Mg	Zn	Mn	Si	Cu	Fe	Ni
Top of 1st Heat	0.09	0.33	0.33	5.79	3.51	0.34	0.13
Top of Last heat	0.09	0.30	0.31	5.79	3.45	0.44	0.14
Bottom of Last Heat	0.07	0.20	1.44	6.69	2.91	3.18	0.02

TABLE 4 . . SEGREGATION PREVENTED BY ADEQUATE MIXING AT ADEQUATE TEMPERATURE

	Mg	Zn	Mn	Si	Cu	Fe	Ni
No Stirring							
Beginning	0.03	1.26	0.33	2.57	6.79	0.88	0.22
Middle	0.03	1.28	0.30	2.52	6.89	1.02	0.21
End	0.03	1.20	0.57	3.04	6.42	2.02	0.25
Stirred Well							
Beginning	0.07	1.40	0.31	2.43	5.80	1.00	0.31
Middle	0.08	1.36	0.32	2.57	6.99	1.02	0.30
End	0.08	1.36	0.39	2.62	6.99	0.99	0.31

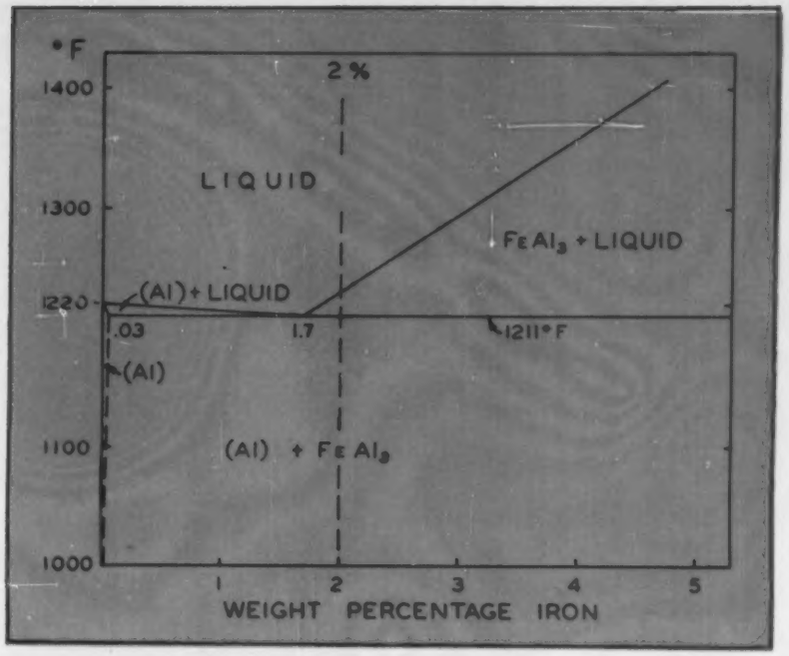


Fig. 9 . . Aluminum end of Al-Fe system helps explain AlFeMnSi formation.

heating to a temperature high enough to have all constituents completely dissolved, and this should be done in the melting furnace.

An example of aluminum and iron pot alloying is illustrated in Fig. 11, a section of aluminum knocked off of the interior of an iron pot. The iron-rich alloy is at the right, and a plate of $FeAl_3$ is apparent in the left layer of aluminum alloy at the center of the photo. Neither of these will dissolve easily in aluminum at the usual temperatures of the holding pot, and if carried into a casting would cause trouble. Normally, they will settle to the bottom of the pot and accumulate as sludge.

Some illustrations of segregation for sludging of an aluminum bath at certain temperatures will be interesting. In one die casting operation, ingot of the composition shown in Table 1 was charged into a breakdown furnace which was operated at 1250 F. Scrap was charged into a breakdown furnace along with this ingot and the surface of the metal was skimmed occasionally but no attempt was made to stir regularly.

After several hours' operation, analyses of samples from the top of the bath and from the bottom of the bath differed considerably, as shown in Table 2 (A). The top composition, therefore, had been transferred to the holding furnace at the machine and the accumulation of the heavy elements in the bottom of the furnace continued.

The practice was then modified so that the furnace was operated at 1300 F, the metal thoroughly mixed and fluxed with a neutral flux and skimmed. Samples from the top and bottom of the bath analyzed as before gave excellent uniformity as shown in Table 2 (B). This metal, when charged to the holding furnace operated at a lower temperature, did not segregate nor sludge even after days of continuous operation.

In another instance, metal was charged into a break-down furnace operated at about 1350 F. The charge consisted mostly of ingot with a few gates, and immediately after reaching 1350 F the metal was skimmed and poured to a heel and another charge melted. Samples taken from the top of the first heat and the top of the fourth and last heat showed uniformity, but at the bottom of the fourth heat, considerable segregation of the heavy element complexes had occurred. The three analyses are given in Table 3 and attention is called to the increase in silicon, iron and manganese.

In this instance, the temperature was satisfactory, but mixing was insufficient. Proper agitation and cleaning would have prevented this segregation. In still another instance, one furnace full of ingot was melted and maintained at 1380 F all day. When no mechanical stirring was done, there again was a gradual increase in silicon, iron and manganese at the bottom of the bath. When the metal was stirred and cleaned regularly, similar analyses of samples from the beginning, middle and end of the day showed excellent uniformity. The two sets of analyses are shown in Table 4.

In the first instance, even though the temperature was sufficiently high, the lack of agitation resulted in incomplete solution and allowed the higher melting point complexes to settle to the bottom as sludge. In the second instance, proper mixing resulted in a homogeneous bath.

In order to eliminate the type of hard spots due to metallic segregation, it is essential that the holding furnace which is operated at the casting temperature receive hot metal only. The melting or breakdown furnace into which both ingot and scrap are charged should be operated at a higher temperature, 1300 to 1350 F, and well mixed before metal is withdrawn. In a hot charging line, it is desirable to have two or more breakdown furnaces so that one may be completely melted, fluxed and stirred while melting is going on in the other. The tapping temperature should be as high as possible, without undue heating of the holding furnace. A 100-degree differential will not be found too great if the relative volume charged into the holding furnace is small with relation to its size.

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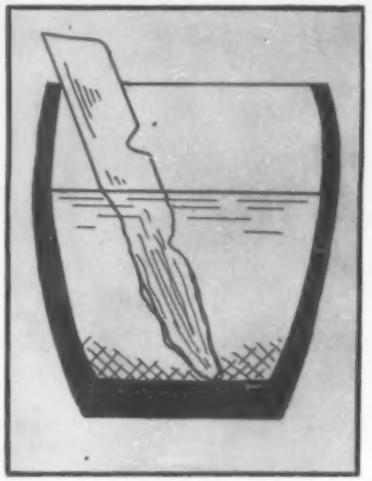


Fig. 10 . . Cold ingot in molten aluminum alloy induces sludging.

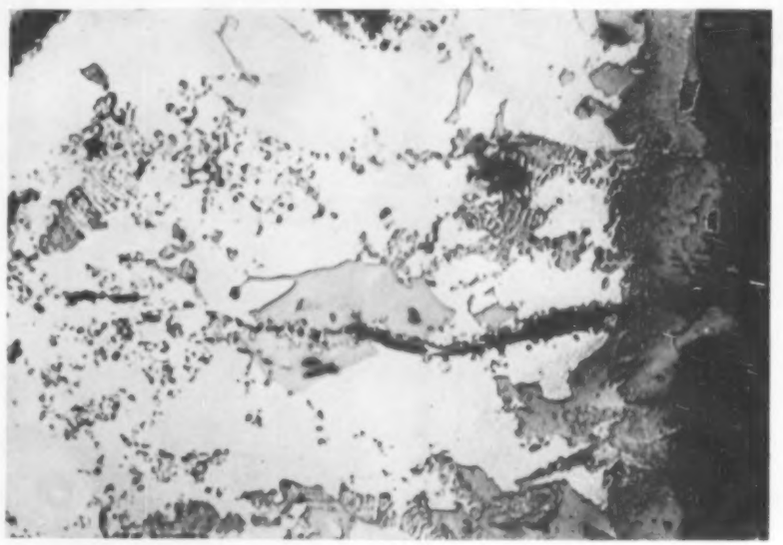


Fig. 11 . . Aluminum and iron pot have alloyed. Iron-rich alloy at right.

AN ACCURATE INVENTORY NEEDN'T TAKE LONG

G. J. BEVANS / *Management Engineer*
Systems Council, New York

This 12-step system will work in any shop

■ However efficient a plant's accounting system, everyone agrees on the necessity of reconciling its book inventory records with an annual physical check of materials actually on hand. Two different methods for taking this physical inventory are widely used. One is to cover all storage areas in the course of a year by checking the stock on a different section of floor each successive week. The other is to do the whole job at one time.

The advantage of the latter method is that it gives an accurate picture of the overall situation, so that all records can be reconciled simultaneously. The traditional objection to taking physical inventory of the whole plant at one time is that it interferes with—often totally stops—production for several days while the job is being done.

Now a method for taking inventory in a large plant in a single day has been perfected by Gene H. Kline, a top accounting executive with the General Foods Corp., in whose plants this method is being successfully used. This system was developed over a period of years for a number of large and small companies in the automotive, aircraft, electrical appliance and farm equipment industries. There is no reason why the system can't be used in *any* industry.

The complete procedure embraces only 12 simple steps.

■ 1. Draw an easily understood diagram of each floor area in the plant to be inventoried. Have sufficient copies made so that each of the two counting teams, you will appoint for every area, may have a copy (at least for that section of floor for which they are responsible), each supervisory team will have a copy, and there will be a surplus, in case some copies become mislaid.

■ 2. Divide the manpower available for the actual counting into two-man teams, and draw up an assignment sheet showing the areas each team is to count. Provide for having each area counted twice by *different* teams. This makes for accuracy.

■ 3. List all classes of items to be counted in each area, indicating how each class is to be recorded; i.e., whether in pounds, barrels, dozens, gallons, etc.

■ 4. Select a two-man team to supervise the counting in each area or group of areas. Usually each supervisory team should consist of the foreman who supervises that section of the plant and an accountant to work with him.

■ 5. Have an established manufacturer of patched system tags supply you with a quantity sufficient for recording on a separate tag the quantity of each different class of material found stored in each separate area to be inventoried. These tags (Fig. 1) should be pre-numbered in sequence. Only an established tag manufacturer has the facilities for producing such tags at the most economical price.

■ 6. Give to each supervisory team a quantity of tags sufficient for the counting teams assigned to the areas under the supervisory team's direction. Record those tag assignments by numbers on an Inventory Tag Control Schedule (Fig. 2). Explain to all concerned that every tag issued must be strictly accounted for.

■ 7. Prepare and issue lists of counting instructions for the guidance of each supervisory team and for all counting teams.

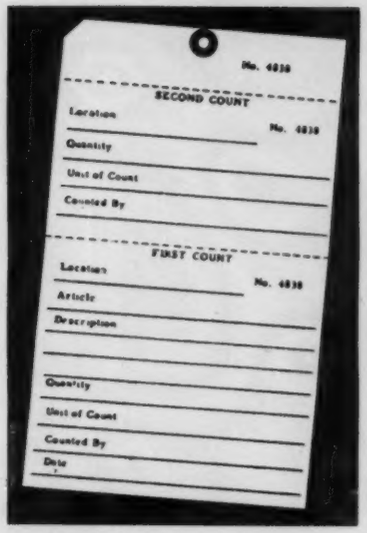


Fig. 1 . . Pre-numbered double tags provide check on count by two different inventory teams.

■ 8. Hold a meeting with all supervisory teams, going over with them your typed or mimeographed counting instructions word for word, and clearing up any questions the men may raise.

■ 9. See that the supervisory teams hold a similar meeting with the accounting teams under their respective direction.

■ 10. As early as possible on the day selected, start the actual count. If tags assigned to a supervisory team for distribution to its counting teams prove insufficient, do not allow the team to borrow any tags from other teams. Insist that they obtain any additional tags needed from a central control so that the tag numbers may be properly recorded on the Inventory Tag Control Schedule.

■ 11. The first counting team counts an area and should attach a tag to each pile or bin counted, fill out the lower section of this tag, tear off this stub and hand it in to the supervisory team for the area. The second counting team records its inventory figure on the second section of the tag, tears this stub off and turns it in to the supervisory team. The supervisory team should require that the numbers on the tag stubs turned in by the second team match exactly the numbers on the tag stubs turned in by the first team.

■ 12. The accountant on the supervisory team should check the inventory figure on each tag stub turned in by the second team against the figure on the corresponding stub turned in by the first team and reconcile any variations. No erasures should be made. Any figures the accountant decides should not be used, should merely have a line drawn through them. The accountant may also classify by a symbol on the tag recording the first count, the nature of the material counted; that is, whether it is raw material, material in process, or finished goods.

All adjustments in figures should be made on the tag stubs used for the first count. Thus only these stubs need be considered in the final tabulation made by the counting department, to which these stubs should finally be routed from the control center.

The advantages of this simple system for taking physical inventory are that it yields records which are highly accurate, fixes responsibility for any errors, and makes the actual counting work relatively easy for the participants. Thus employment of this simple system eliminates most of the headaches usually incident to this laborious and unloved task of taking physical inventory in your manufacturing plant.

INVENTORY TAG CONTROL SCHEDULE

Prepared By _____ Date: _____

BUILDING	INVENTORY LOCATION NUMBER	ASSIGNED FOREMAN	ASSIGNED ACCOUNTANT	PRE-NUMBERED INVENTORY TAGS CHARGED OUT	NUMBER OF TAGS CHARGED OUT	TAGS RET'D SPOILED OR VOIDED	SIGNATURE OF ACCOUNTANT RECEIVING TAGS
C&C Basement	B-1	Smith	Fletcher	801-875	75		
	B-2	Black	Fletcher	876-150	75		
C&C 1st Floor	PR	Parker	Martin	151-300	150		
C&C Warehouse	W-1	Burns	Hagen	801-950	150		
No. 2 Warehouse	A-1	Myers	Long	951-1050	150		
Yard (Skids & Drums)		White	Long	1051-1100	50		

Fig. 2 . . Tag control schedule summarizes inventory, accounts for tickets.

MARKETING YOUR PRODUCT

A MODERN CASTINGS BONUS

S. C. Massari, National Engineering Co., this year's Hoyt Memorial Lecturer, puts his finger on one of the foundry's major problems.

Foundrymen must recognize that castings will have to meet customers' needs or a competitive product will

The PROBLEM OF SELLING CASTINGS

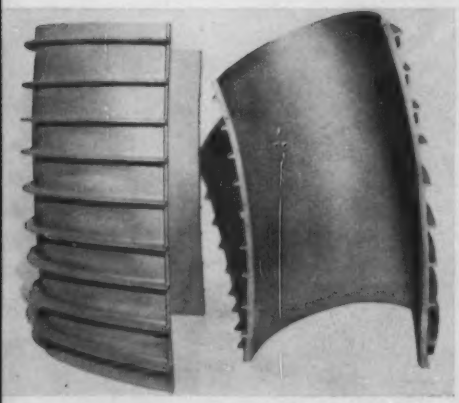


Fig. 1 . . Cast magnesium duct.

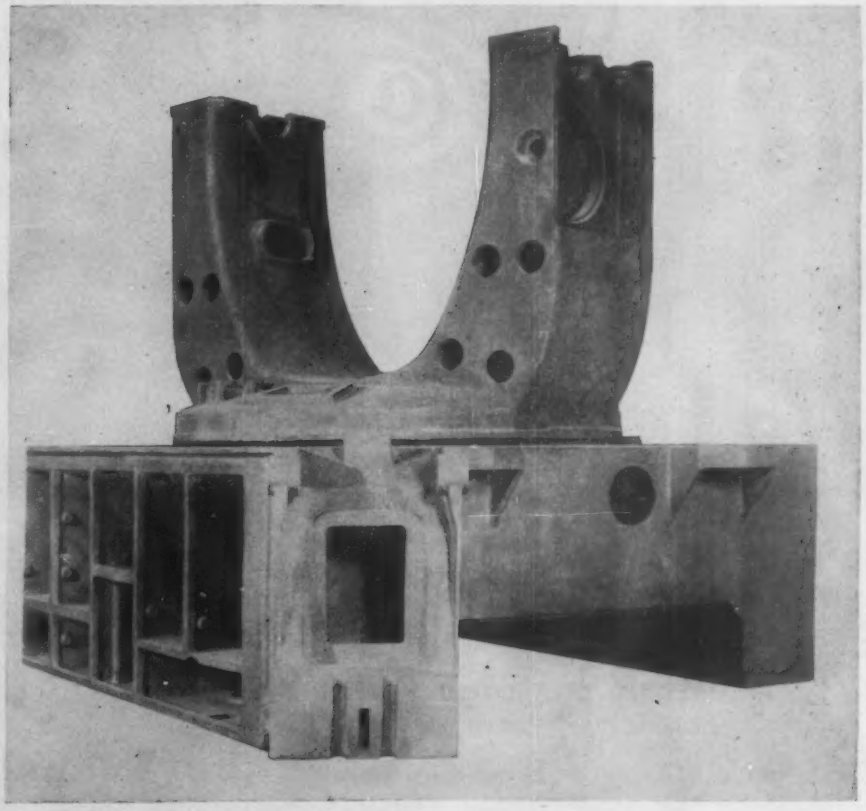
■ We, as foundrymen, thoroughly believe in the merits of castings but it is equally important that our customers recognize their value. In our highly competitive market we must keep our product before the eyes of the purchaser, develop improved manufacturing techniques, and maintain a competitive selling price. We must also improve casting quality, develop new applications, and satisfy increasingly rigid specifications to meet competition from other manufacturing methods and materials.

Customers of tomorrow will expect even more from us and if we are to enjoy their business castings will have to meet their needs or our competitors' product will.

In the past the making of castings was largely an art while today it is developing into an exact science. Foundrymen are fortunate to have technical groups such as the American Foundrymen's Society and the several industry trade groups where management and technologists gather for the exchange of information relating to metals, processes and manufacturing equipment. Tremendous developments in industry are taking place creating a serious challenge to our industry. Research is one of the most effective means of avoiding obsolescence by a competitive product or process which serves in a new, better or cheaper way.

Through research and process control, the industry must energetically pursue a program aimed at producing the very finest product at the lowest cost.

Fig. 2 . . Base for mobile military electronic unit is cast in magnesium.



MARKETS CHANGE RAPIDLY

■ The greatest need for research and new product development may not be to increase profits but to maintain them. Obsolescence of existing castings applications results in diminishing tonnage. Typically, the chilled iron wheel is being replaced by either the wrought or cast steel wheel; large quantities of steel castings formerly used on steam locomotives are no longer required with the advent of diesel-electric motive power; the modern domestic gas range, made of stampings, has totally outmoded the large quantities of stove plate once made in foundries. Today, even such a simple casting as a sash weight is being supplanted by various forms of spring loaded devices.

Improve Foundry Processes

Our industry must improve foundry processes to retain existing markets, recapture at least some of those already lost and equally important, discover and develop new markets.

Ralph J. Cordiner, president of the General Electric Co., recently stated, "In the next five years, 90 per cent of all industrial production will emanate from the research and development work currently in process." In an era of such rapid industrial changes the foundry must be constantly alert for new applications of castings to counteract the loss of business caused by the obsolescence of old.

We must do more than just wonder how the foundry will prosper in this atomic age. Many of the progressive foundrymen are alert to the necessity for new product development and the application of casting methods so as to do the job better by lowering the manufacturing cost or producing a structural member which performs better in ultimate service.

Expand Through Redesign

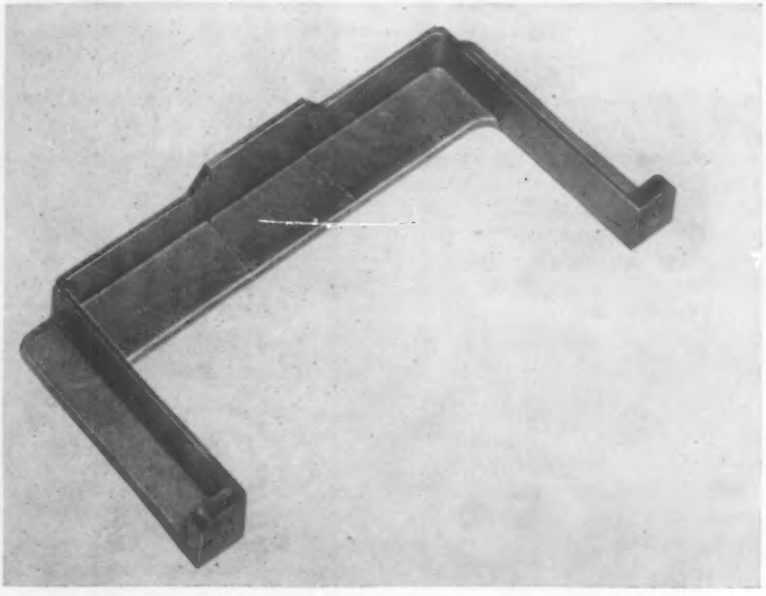
Through the cooperation and courtesy of a number of friends in the industry, it has been possible to assemble a variety of typical examples showing where a change in design and the application of good foundry engineering has replaced less desirable methods of manufacture.

They show the potentiality of market expansion through new product development. In some instances, these developments are the result of new foundry techniques to produce better castings at lower overall costs while in others the casting replaces a structural member formerly made of a weldment which was inadequate in actual service.

Don't Overlook Alloys

Still another approach lies in the field of alloys. This is especially well suited for application of cast alloys which cannot be wrought or are practically unmachineable. Such alloys find their use in the category of corrosion or wear resistance and in applications where high temperatures are involved.

Fig. 3 . . Magnesium permanent mold casting saved welding labor, cost less.



PRODUCT DEVELOPMENT Opens New Markets

■ **Magnesium.** Through the cooperation of M. E. Brooks of the Dow Chemical Co. and E. V. Lanfranke of the Rolle Manufacturing Co., Inc., it was possible to obtain some excellent examples of magnesium alloy casting developments.

A cast magnesium alloy air duct is shown in Fig. 1. This duct is 38 in. long, 20 in. across and 20 in. high. Originally these air ducts were fabricated but due to excessive vibration in service, stresses, nuisance of fabricating and lower overall cost, it was redesigned and cast from AZ91 alloy. The foundry recommended that the duct be made of two half castings which were subsequently welded along the flange line to make the complete duct. The finished duct (two half castings) weighs only 24-3/4 lb and has a wall thickness held to 0.125 in.

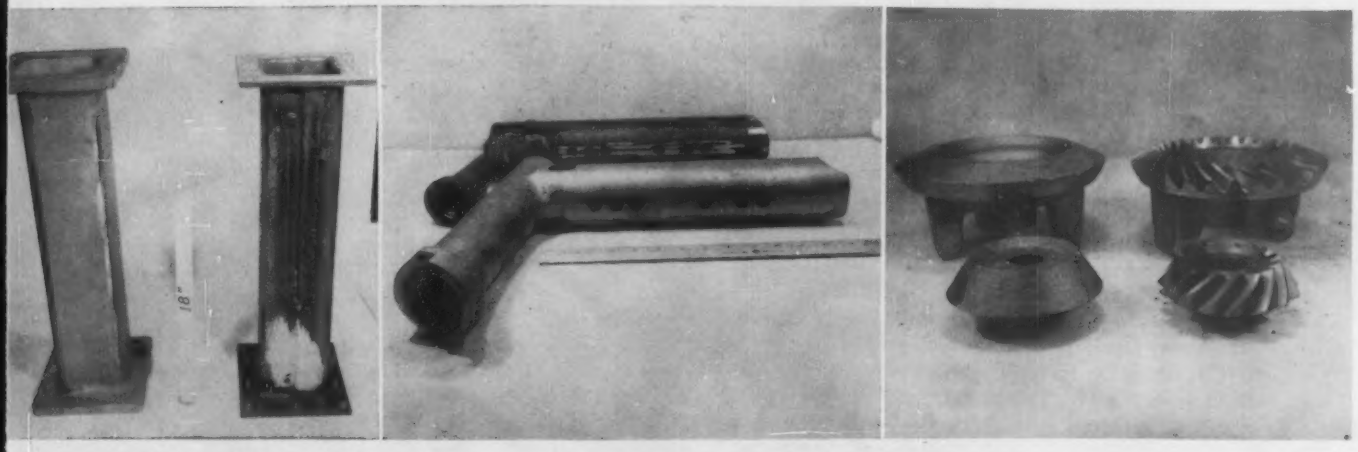
A large base casting for a mobile military electronic unit is shown in Fig. 2. The design engineers originally contemplated fabricating this base but because maximum dimensional stability was desired it was made as a sand casting. The finished casting weighs 1500 lb and was cast of AZ63T6 magnesium alloy. The overall dimensions are 8 x 8 x 3 ft, with a wall thickness of 3/8 in. This provides an excellent example of how a casting not only eliminated a very substantial amount of welding labor but, more important, fulfilled one of the most important ultimate requisites—dimentional stability.

A comparatively small, permanent mold alloy magnesium casting is illustrated in Fig. 3. The approximate overall dimensions are 2½ x 6 x 3/4 in. and it weighs only 1½ oz. This part likewise was originally fabricated by welding methods. Since the anticipated requirements did not justify the high initial cost of a die it was cast in a permanent mold.

The customer was very well pleased with the cast parts and, in addition, the casting eliminated considerable tooling and the added labor of fabrication. Last but not least, the casting cost less than the fabricated part. This can certainly be considered a fine example of new product development.

■ **Malleable iron.** A varied and

Fig. 4 (left) . . Malleable casting eliminated field failures in weldment. **Fig. 5 (center) . .** Malleable front axle for tractor was better, cost less than weldment. **Fig. 6 . .** Pearlitic malleable pinion and bevel gears beat forgings on price.



large tonnage of malleable iron is used in the manufacture of farm implements but like the other branches of the foundry industry, new applications must be developed to compensate for losses resulting from obsolescence and the design of new machines having entirely different component parts. A fruitful field also exists in the development of castings to replace weldments which have shown excessive field failures. Following are some typical examples of a cooperative effort between the design engineers and the foundryman.

Indirect Advantages

Both the welded and cast versions of a supporting member for a heavy combine are illustrated in Fig. 4. Even though the cost of the malleable casting was approximately the same as the welded fabrication it was much stronger. Adoption of the casting eliminated field failures of this member which had formerly resulted in the fabricated design due to cracking of the welds in service. Indirect advantages of the casting are the reputation of the implement manufacturer as a producer of trouble-free equipment and the elimination of attendant service expense when structural failures occur in the field.

Similarly, the unsatisfactory field performance of a tractor front axle end resulted in its conversion from a fabricated design to one piece malleable casting. Field failures of the component, likewise, were due to cracking in the welds. The fabricated and cast designs are shown in Fig. 5. In addition to the advantages already enumerated, the manufacturing cost of the casting was less than the weldment.

Even though many applications, because of service conditions, will not permit such a conversion, Fig. 6 illustrates a pinion and bevel gear blank (as cast and after machining) which are now made of pearlitic malleable. These blanks formerly were forgings.

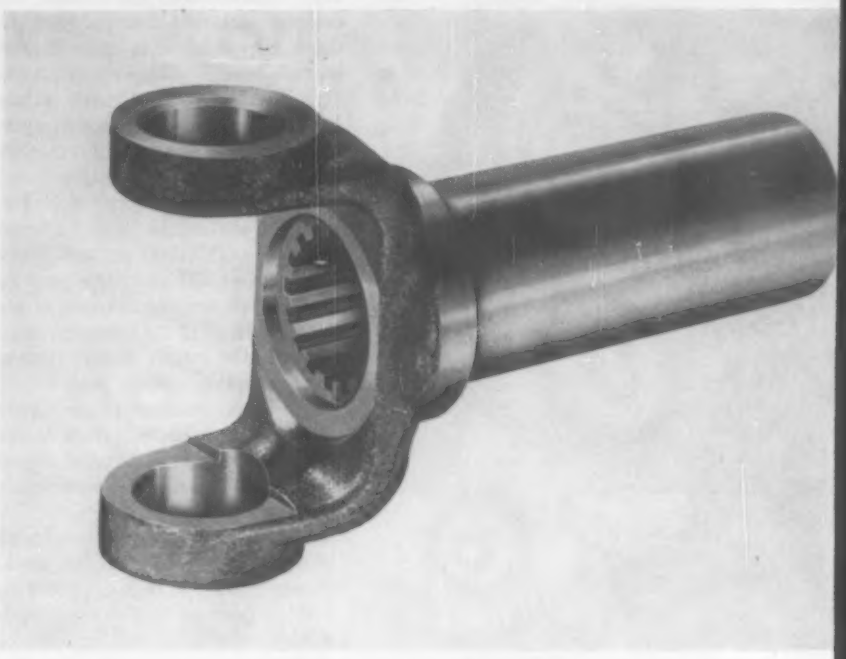


Fig. 7 . . Universal joint yoke of pearlitic malleable cut machining costs.

The cost of the pearlitic malleable gears, including final heat treatment, was 36 per cent less; the material cost alone was 56 per cent lower and the labor cost 25 per cent less for the casting than the forging. The flame hardened pearlitic malleable gears have performed very satisfactorily in service.

▪ **Pearlitic malleable.** Within recent years the applications of pearlitic malleable have increased greatly. When the conventional grades of malleable iron do not meet strength requirements or wear resistance, it has, in certain instances, been very satisfactory as a substitute for fabrications or forgings.

Through Carl F. Joseph and the cooperation of the Central Foundry Division, General Motors Corp., some excellent examples of such conversions are illustrated. Special mention should be made of the fact that in each case there was a saving in the cost of the rough casting and, in addition, a reduced machining cost—a dual economy to the purchaser.

A universal joint yoke made of pearlitic malleable is shown in Fig. 7. This part had formerly been forged of SAE 1145, a free cutting high sulphur steel. Substantial savings in the cost of the rough casting and machining of the part were achieved.

Typically, the internal spline, which is broached, under comparative tests gave a broach life of only 9,000-10,000 pieces on the forgings while the pearlitic malleable castings yielded a broach life of 15,-000-20,000 pieces. When the part was forged, it was necessary to resharpen the broach after each run of 800-900 pieces. After the yolk had been converted to pearlitic

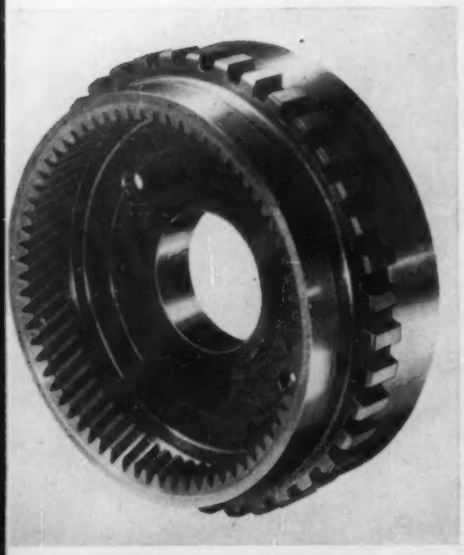


Fig. 8 . . It's pearlitic malleable.

malleable iron, 1500-1800 pieces could be machined before the broach had to be re-ground. The carbon spots in pearlitic malleable permit the machine chips to break off readily, improving machine time and tool life.

The pearlitic malleable of which this casting is made has an ultimate tensile strength of 100,000 psi and a yield strength of 80,000 psi. When subjected to fatigue cycling tests the casting stood up as well as or better than the steel forgings.

A reverse internal gear is illustrated in Fig. 8. The gear blank formerly was forged from SAE 5140 steel containing 0.40 per cent carbon and 0.95 per cent chromium, commonly known as a medium chromium steel. To provide the necessary draw angles on the forging die considerable extra machining was required to remove the surplus stock.

Substantial Savings

The internal teeth of this gear must withstand the full thrust of the reversing pinion gears and to accomplish this a surrounding brake band holds the part stationary. To withstand the intense load on the internal teeth, the part must be made of a high strength material. It is also important that the exterior surface have a very high finish to insure smooth operation of the brake band on the friction surface without chatter.

The part was converted to a pearlitic malleable having a tensile strength of 100,000 psi and Brinell hardness of 241-269. The new cast design reduced the amount of metal which had to be removed in machining; the rough casting cost was less than the forging and because of its better machinability resulted in reduced machining cost. In service, the casting performed equally satisfactorily and the foundry has another satisfied customer.

The crankshaft sprocket formerly machined from steel for stock is shown in Fig. 9. It is apparent that a large portion of the original bar stock is wasted in the form of metal chips.

Pearlitic malleable has replaced the bar stock at a lower material cost, fewer machining operations and a greatly reduced total machine time. Following machining, the sprocket teeth are flame hardened by heating for about eight seconds and quenching in oil held at 130-150 F. The final tooth hardness ranges from Rockwell C55-58. The finished sprocket has strength and wear resistance comparable to the steel bar stock parts.

A typical conveyor trolley wheel is pictured in Fig. 10. In this application, a pearlitic malleable casting is used to replace an SAE 1040 steel forging. The casting has a Brinell hardness of 197-241 and the wearing surfaces are induction hardened to a Rockwell hardness ranging from C50-55 to a depth of 1/16 in. The cast wheels cost less than the steel forgings and because of their excellent machinability, lower machining time and longer tool life result. Based upon accelerated life tests, the customer reports wear resistance comparable with or better than forged steel wheels of like hardness.

The common "C" clamps shown in Fig. 11 were originally steel forgings made from SAE 1040 steel.

Low tool life, high machining and forging cost, plus excessive metal resulted in converting these clamps to pearlitic malleable castings. The conversion resulted in substantial savings but the strength of the forgings was retained.

▪ **High alloy steel.** The application of casting techniques is well portrayed in the field of highly alloyed steel castings which must withstand corrosive media or exhibit relatively high strength at elevated temperatures. Especially noteworthy in the following applications is the wide latitude afforded the design engineer. These parts are so complicated as to be almost impossible of economical manufacture by other methods.

Minimum Machining

A complicated austenitic 310 stainless steel casting is illustrated in Fig. 12. This part was cast in an investment mold. The complex design of the casting practically rules out economical production by other than foundry techniques and due to being investment cast requires the minimum machining.

Another intricate jet engine fitting is shown in Fig. 12. This part was also investment cast of a type 302 stainless steel.

Again, Fig. 13 was cast because of its intricacy. Note the cast-in holes, recessed areas and varied shape, yet functional design has been accomplished with minimum weight. Machining only required facing and tapping of the threaded holes.

Because of the relatively small quantities and close dimensional tolerances demanded, the casting in Fig. 14 was investment cast. This gas turbine oil fitting was also cast of a type 302 stainless steel.

Although this casting appears very simple, its shape is relatively intricate since all holes were cored and the angled bevel was cast so

that the only machining to produce the finished piece required was tapping the threads.

▪ **Nodular iron and shell molding.** The development of nodular iron combined with shell molding has opened an entirely new field for the foundry industry. The inherent mechanical properties of nodular iron make it well suited for the manufacture of structural members where relatively high strength combined with ductility are important. Close dimensional tolerances together with excellent casting finish, characteristic of the shell molding process, have materially lowered machining costs—a strong selling argument for the casting salesman.

T. W. Curry, Lynchburg Foundry Co., has made available some excellent examples in this field. A typical crankarm is illustrated in Fig. 15, originally fabricated as a weldment and then redesigned for shell molding and casting of nodular iron. It is interesting to note that the arm is poured in a vertical position and that both bearings must be risered to obtain solidity in these locations. Two castings are made in a mold and the gate and runner enter the risers. In addition to economy of manufacture, field experience shows that the bearing characteristics of the ductile iron casting are superior to the weldment.

A combination pinion gear and sprocket are shown in Fig. 16. This gear was formerly a fabrication made of a malleable iron pinion gear, a steel tube and a stamped steel sprocket. The part is now cast of nodular iron in a shell mold as an integral unit. The space between the pinion and sprocket is formed by a conventional foundry core with the balance of the casting in a shell mold. The gear teeth require no machining and are hard and ductile enough in the as-cast condition to be ideal for the application involved. Little thought is required to appreciate the economic advantages involved in this conversion.

A typical crankshaft is illustrated in Fig. 17. Almost unlimited possibilities are available for the conversion of forged crankshafts to nodular iron, in many instances cast in a shell mold to minimize machining cost. The cast crankshaft offers broader latitude to the design engineer and, equally important, at a lower final cost. At least in the smaller sizes, the nodular iron crankshaft can be used either in the as-cast state or with some form of subsequent heat treatment. (The full potentiality of foundry industry in this field is emphasized by the recent announcement of the General Motors Corp. that the Pontiac crankshaft is now to be cast of pearlitic malleable in shell molds.)

All three of the Lynchburg examples were cast of ductile iron having the following properties:—

Ult. tens. str.	90,000-115,000 psi
Yield strength	65,000- 85,000 psi
Elongation	2½% - 5%
Brinell hardness	200-269

This iron is melted in an acid-lined cupola, desulphurized in a forehearth by injecting calcium carbide and then treating the iron with a combination of Mg-Ce-Si and Ni-Mg-Si alloys, followed by a late ferrosilicon inoculation before pouring.

▪ **Gray iron.** Our most versatile cast metal is gray iron and likewise it represents the largest tonnage. A large variety of cast irons having a broad range in mechanical properties afford the design engineer wide latitude in structural design combined with economy of manufacture, service performance and ease in machineability. The excellent vibration dampening capacity of gray iron, for example, in the case of engine and machine tool components results in quiet operation and excellent finish on the machined parts since harmonic vibrations are at a minimum when the machine is in operation. The outstanding casting characteristics of gray iron make possible contours and complexity of design impractical by other methods of manufacture and often at substantial savings in cost. Hence, even in our modern times cast iron still continues as one of our most important structural materials.

The Gray Iron Founders' Society sponsors a contest to encourage

Fig. 9 . . Formerly bar stock.

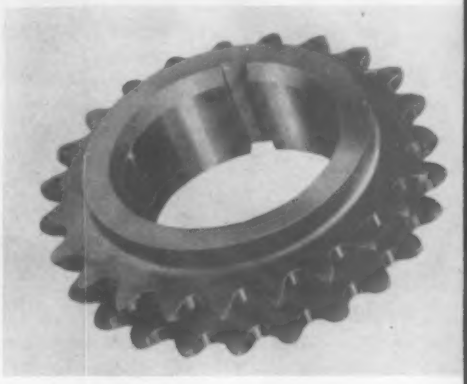


Fig. 10 . . Replaced a forging.

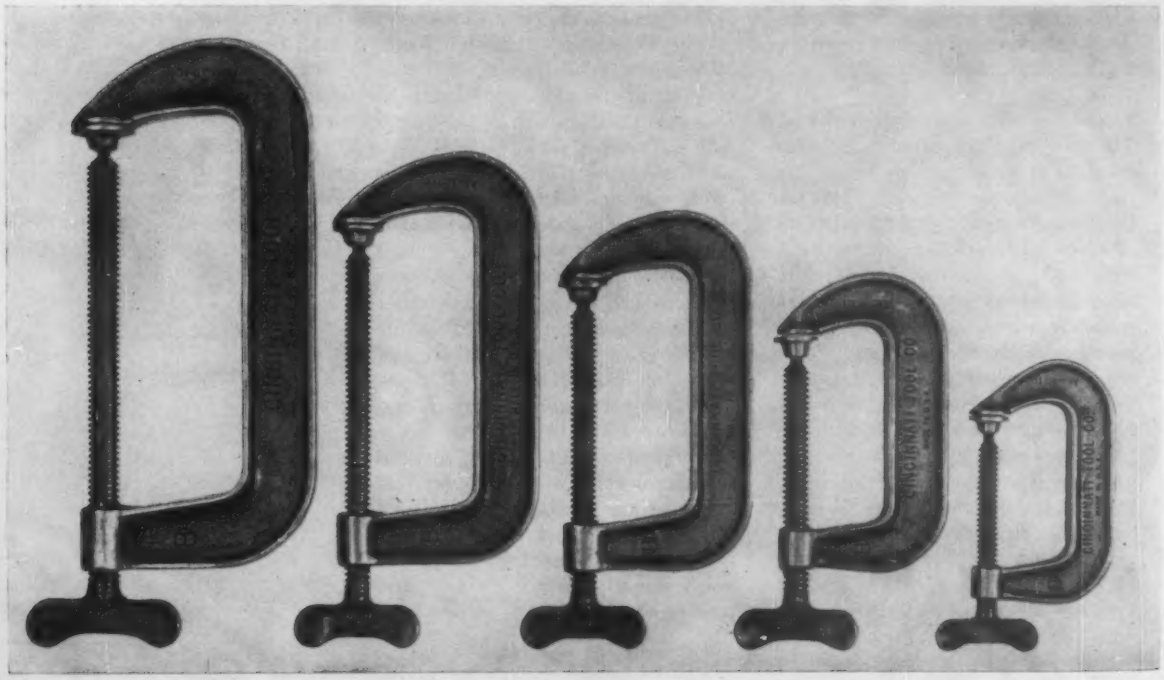


Fig. 11 . . Malleable iron clamps are just as strong and cost substantially less than formerly used steel forgings.

gray iron foundrymen to develop ingenious designs for castings to replace other methods of manufacture resulting in a saving in production cost and, equally important, better service performance. Through the cooperation of the Society, several excellent examples of such gray iron applications have been made available.

A machine tool spindle housing is shown in Fig. 18, originally fabricated as a weldment from a number of steel components. The same housing is shown after it was redesigned and cast of gray iron. The manufacturing cost of the weldment was $218.57 while the gray iron casting cost only $109.67—a saving of $108.90 per unit or a reduction of slightly less than 50 per cent. In addition, no one will deny that the casting has considerably improved eye appeal.

A fabricated automatic valve and a redesigned version in gray iron are illustrated in Fig. 19. This conversion not only resulted in reducing the production cost from $338.42 to $91.71—a saving of approximately 70 per cent—but also eliminated an annoying service problem caused by leakage in the fabricated assembly. Why shouldn't this have created another satisfied customer for the foundry industry?

When the chain box shown in Fig. 20 was converted from a weldment to a gray iron casting the initial cost was lowered from $21.00 to $9.22 and the machining cost reduced from $23.50 to $12.50 —or a total reduction in cost of the finished part from $44.50 to $21.72. Thus the finished casting was produced at an overall saving of about 51 per cent.

The speed reducer housing illustrated in Fig. 21 had been fabricated of 69 parts but after modification in design was cast of only two gray iron parts. This conversion resulted in a 73 per cent saving on cost of unmachined pieces and 20 per cent saving on machining cost. The performance of the gray iron casting is superior because of its ability to absorb vibration and operate more quietly. The savings on the first three units covered the difference between pattern and template costs. Again, in appearance, there can be no question as to which looks better.

These are only a few typical examples of new applications for castings and many more are available. Each attempt requires a careful analysis of the customer needs, service requirements, the economics involved and the closest cooperation between the foundryman and the design engineer. Sound engineering combined with a thorough knowledge of castings and their advantageous application are required. All these help in marketing.

A MARKETING PROGRAM for YOUR FOUNDRY

■ Several phases of marketing castings can be briefed in the following:—

A. Planning
   1. Market analysis
   2. New plant facilities and processes
   3. Complete customer and prospect records

B. Sales Effort
   1. Salesman training
   2. Scheduling of sales calls
   3. Manufacturers' agents
   4. Complete sales records

C. Advertising
   1. Budget
   2. Trade publications and newspapers
   3. Engineering letters—direct mail
   4. Complete brochures or catalogs
   5. Open house
   6. Exhibits at industrial shows

D. New Product Development
   1. Cooperative engineering with customer
      (a) Improved performance
      (b) Weight reduction
      (c) Lower machining or assembly cost
      (d) Improved metallurgy
      (e) Lower initial cost
   2. New applications for castings in newly developed products

■ **Planning.** Market analyses are, in many respects, not nearly as difficult as most foundrymen presume. A number of reliable sources of information are readily available at comparatively low cost. Directories of manufacturers are available, categorized into three general headings: alphabetical order, product, and geographical location. These directories frequently include the names of key personnel and total number of employees. The information obtained in this manner is very helpful in preparing a list of prospects and a direct mailing list. Although they lack some desired information, classified telephone directories are also an added source.

Excellent additional sources are publications such as **Mac Rae's Blue Book, Poor's Register of Directors and Executives, Thomas' Register of American Manufacturers, Reference Book of Dun & Bradstreet, Inc.,** and the advertisements in a considerable number of industrial and engineering society magazines. From these sources, card file records can be prepared for all prospective customers.

Final verification can usually be accomplished only when the foundry salesman makes a personal call. During such a visit, the salesman

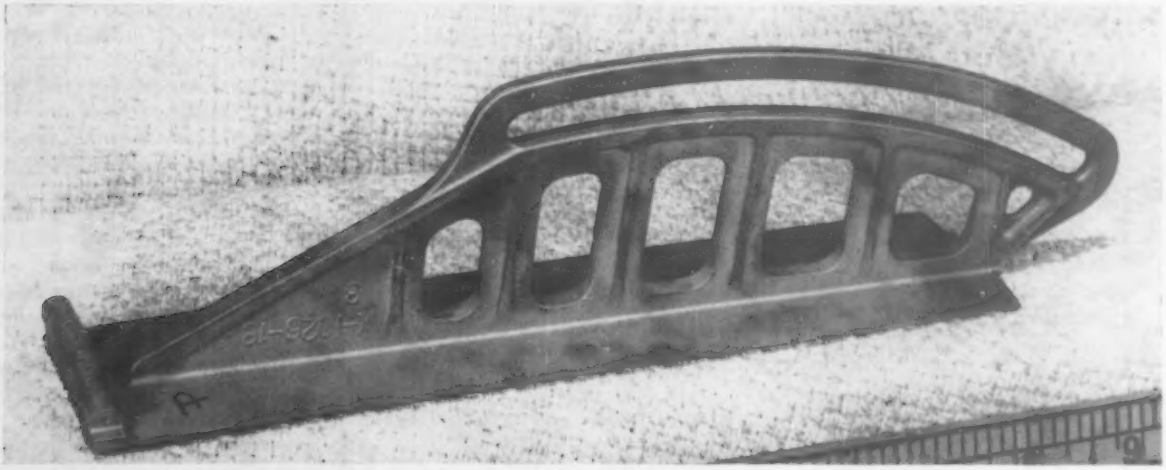


Fig. 12 . . Complexity of this stainless steel part ruled out techniques other than casting for reasons of cost.

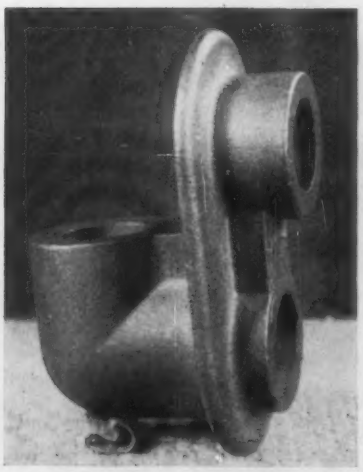


Fig. 13 . . It's investment cast.

should determine the kind of castings, approximate volume, whether present sources are considered satisfactory, general quality of castings the company is presently buying, an estimate of the size and character of the company and its ultimate product.

The salesman should, of course, acquaint the casting buyer with the manufacturing facilities of his foundry, the type of castings it is unusually well qualified to produce and, if possible, get an opportunity to quote on some castings.

Make Frequent Calls

The salesman should be held responsible for a complete report on every call so the sales manager can make final decisions on all matters of policy. If the prospect looks promising, subsequent calls should be made to emphasize the desire of the foundry to serve the customer. Frequently several calls must be made before the first sale. Even when conditions favor a change in casting source—the buyer knows from past experience that a new source will require time to make sample castings and adjust to the manufacturing technique before wholly satisfactory castings are delivered.

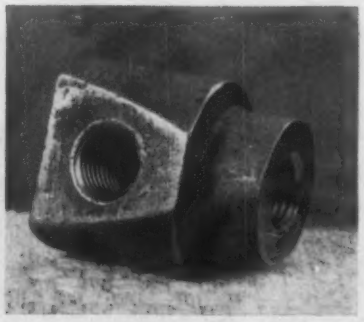


Fig. 14 . . Needed only tapping.

These steps cost time and money even if we ignore the fact that the new foundry must by actual manufacture prove it is capable of making acceptable castings at a lower price and adhere to required delivery schedules.

The sales organization should call on each of the prospective customers included in the lists prepared from the sources enumerated. Utilizing the salesmen's visitation report those firms can be eliminated which either do not use castings or are of a kind, size and quantity unsuited for economical manufacture in your foundry. The original names should be grouped geographically to minimize time and travel expense.

Eventually, the foundry will develop a list of prospects which comprises firms whose casting purchases justify intensive sales effort. The list also provides names for a direct mail advertising campaign, the details of which will be described later. The prospect list must have continuous attention and be kept up-to-date by the posting of new information relating to any of the firms plus the addition of new ones. It becomes one of the most valuable assets of the sales department and represents one of the first steps in a systematic sales effort to explore new markets.

■ **Sales program.** The word "salesmanship" is comparatively new in our vocabulary. It is not even found in the 1900 edition of Webster's Unabridged Dictionary. Advertising may be considered a part of salesmanship but differs in that the element of personality does not enter into it. Salesmanship proper is a matter chiefly of the personal relationship involved in selling.

The latter is stressed because the selling of castings, much more so than most commodities, is accomplished by a personalized influence rather than through the creation of a market as a result of large scale advertizing and a big distributing organization. Each casting requires individual attention if it is to best serve the customer. The foundry salesman is the medium by which casting requirements are transmitted to the foundry operating personnel. Only through such intimate communication can the foundry produce the casting so that it will meet the customer's needs at the lowest cost. This emphasizes the necessity for adequate training of the foundry salesman, the primary responsibility of the sales manager, supplemented by the technical staff of the foundry.

Contact Design Engineers

Selling castings is an engineering job and, in many instances, the salesman should be accompanied by a member of the foundry technical staff when working out the engineering details with the customer's design engineers. Matters such as the most desirable pattern equipment, design of the casting, metal sections, dimensional tolerances, distortion, critical areas, finish allowances and the required physical and mechanical properties of the metal are essential to the successful manufacture of a casting.

The primary contact with any customer is the purchasing agent or castings buyer; but it is equally important to have intimate contact with the design engineers. He is the man who knows the ultimate needs of the casting and the one who can cooperate in making the design a practical one from the casting standpoint. The design engineer, likewise, is the man who

is interested in the engineering properties of the metal so that its qualities may be used to best advantage. Engineers welcome information, providing it is factual and presented by a trained engineering salesman.

Show Interest in Business

Sales calls should be systematically planned. Up-to-date records should be maintained showing date of the last call, extent of sales, service calls—including reason and results—date when a customer stopped buying and why, as well as new prospects together with estimate of potential business. Calls should be frequent enough so that the customer feels you are interested in his business. At intervals, the foundry president should call on the more important customers. A close relationship once established between the customers' executive officers and the foundry president serves to cement their mutual relations in a manner unattainable in any other way.

Comparatively recently a survey was made of what happened to 100 customers of a firm over a 10-year period. The results were quite startling. Of a total of 100, 15 customers quit during the first year; 13 during the second year; 11 during the third year—and so on until at the end of the 10-year period only 19 active customers remained. Of the former 100 customers who could be located, 68 per cent had withdrawn patronage because of discourtesies, poor service, or indifference; another 14 per cent had gone elsewhere because of unadjusted grievances. Price cutting or buying for less had lost only 9 per cent. In other words, 82 per cent of the original customers had been lost purely through neglect.

Old customers are more valuable than new ones. They are familiar with you and have confidence in your company's products, services and personnel. It pays to keep them. Retention of old customers requires only half the effort necessary to acquire new ones.

There are instances where a small foundry that cannot support a large sales force or even a large foundry that may want to supplement its sales effort will employ the services of a manufacturers' representative. He is an independent operator selling on a commission basis. He is frequently very profitably used in areas where the total potential volume of business is not great enough to justify the cost of a full-time salesman. No financial investment is involved because the manufacturers' representative is not paid until the sale has been made and the castings are shipped to the customer.

Since such an agent will represent the foundry in the eyes of the customer it is important that he be selected with the same care used in hiring a new salesman. It is also just as essential that he be as well informed as a full-time salesman on the manufacturing facilities of the foundry, the class of castings it is best qualified to produce and its overall policies. The foundry must be prepared to support him with an adequate promotional and advertising program as well as technical assistance and prompt preparation of quotations when requested.

■ **Advertising.** Advertising is a form of mass communication which

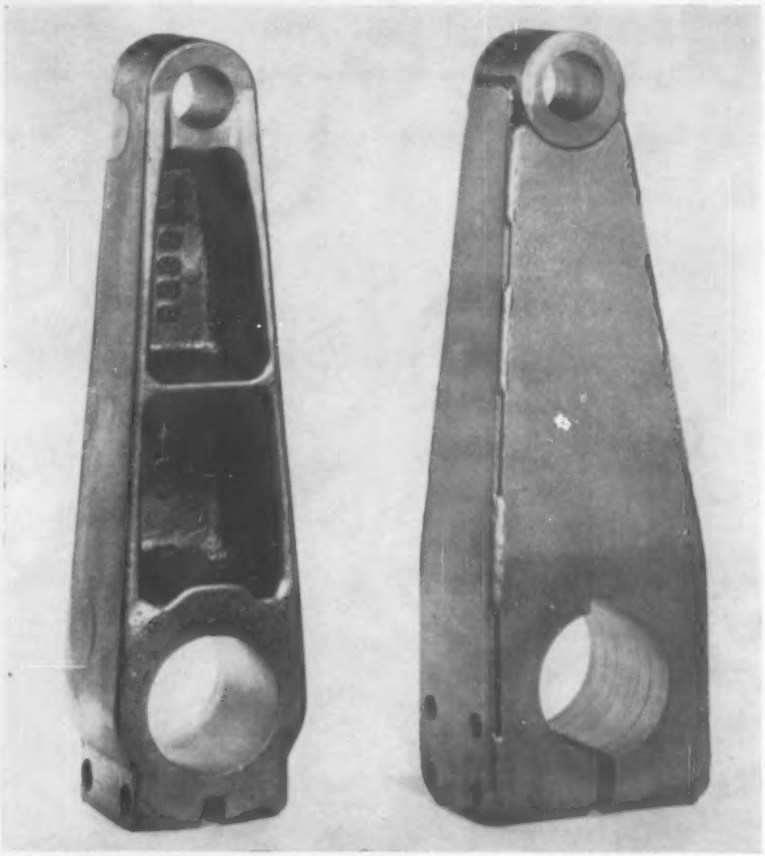


Fig. 15 . . Welded crank arm was redesigned for nodular iron, shell mold.

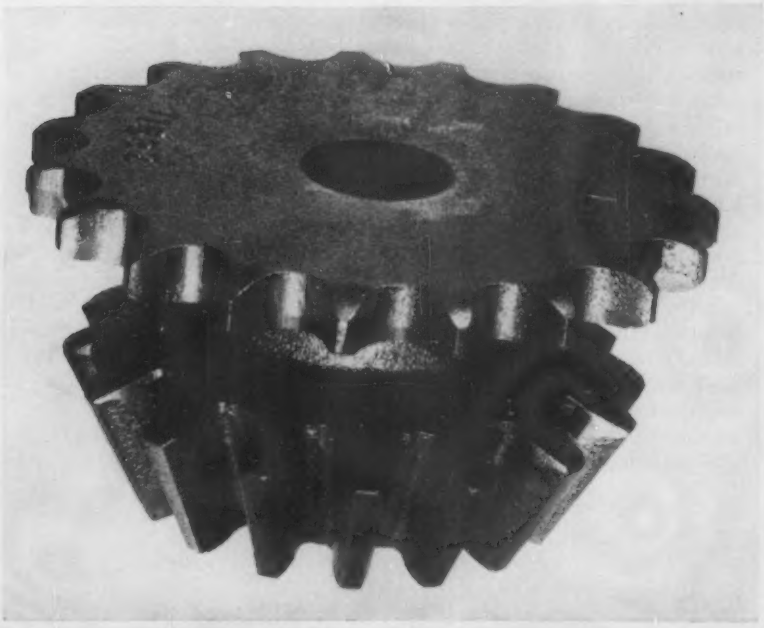


Fig. 16 . . Three parts became one and machining, assembling was eliminated.

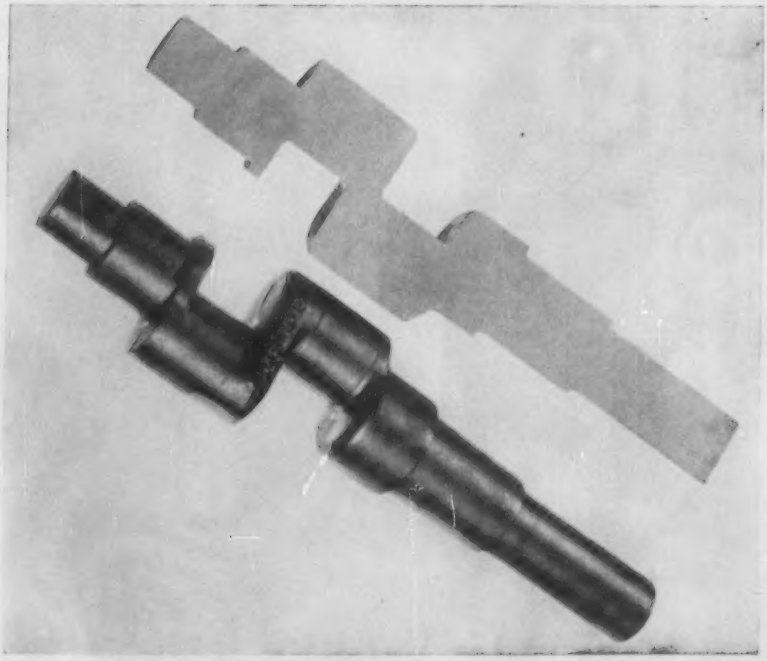


Fig. 17 . . Cast crankshaft offers broader latitude at lower final cost.

keeps the name of the foundry before the eyes of its existing and potential customers. It also informs the public of the types of castings the foundry produces, the merits of its product and the uses for the castings.

Lowers Sales Costs

Advertising helps reduce the costs of selling by salesmen. According to a survey conducted by the Sales Executive Club of New York by contacting 228 representative manufacturers of industrial materials, equipment and services, the average cost of a salesman's call on a prospect was $17.24 and ranged from $5 to $30 per call. This clearly indicates how judicious advertising is a means for lowering sales costs by providing inquiries which result in a higher percentage of profitable sales calls, to say nothing of potential customers which might be totally overlooked due to a lack of knowledge of their needs. Frequently it is the practice of a purchasing agent to file advertisements for future reference as possible sources for specific items.

An annual advertising budget should be established showing a breakdown of how it is to be used. Several types of advertising may be considered appropriate and profitable in the foundry industry such as trade or professional societies, publications, newspapers, direct mailing, complete brochures, catalogues, open house at the plant and casting exhibits at industrial shows or conventions. Each serves a definite purpose, the value of which must be determined by foundry management in terms of the market it wishes to stimulate and what it desires to accomplish.

With few exceptions, foundries have seldom advertised in daily newspapers. Exceptions are occasionally observed in which a foundry is publicizing open capacity for the production of a specific class of casting but such advertising is spotty and does not constitute a consistent effort in general practice. Its value is restricted and fails to

inform the purchaser of the skill and manufacturing facilities of the foundry.

Industrial publications, by comparison, provide a valuable form of advertising for the industry, especially if the primary theme concentrates on subjects which will stimulate the interest of the design engineer as to the many advantages of castings over other methods of manufacture.

The desirable physical characteristics of the casting in terms of ultimate service performance should also be emphasized. An abundance of factual engineering information is available emphasizing the multiple advantages of castings. The industry, for the most part, has neglected to use this data as one of its most effective selling arguments. The casting process has inherent characteristics which cannot be equalled in many instances by other methods of manufacture. We must capitalize on these advantages by making our customers fully aware of them.

Closely associated with this segment of available advertising, the magazines published by the various professional groups, such as those of the civil, mechanical, automotive, electrical, chemical, etc., societies should be included. These publications are produced by and for engineers—the men primarily responsible for selecting the method of manufacture and the men who must be made aware of the attributes of castings.

Technical Papers Valuable

Well prepared technical papers presented by foundry technologists before the same engineering groups constitute a valuable form of advertising which is both direct and enduring. Such papers, when reproduced in the publications of the engineering societies, result in a highly selective national coverage. Since these same publications are available to engineering students in our colleges, information on the application and merits of castings is

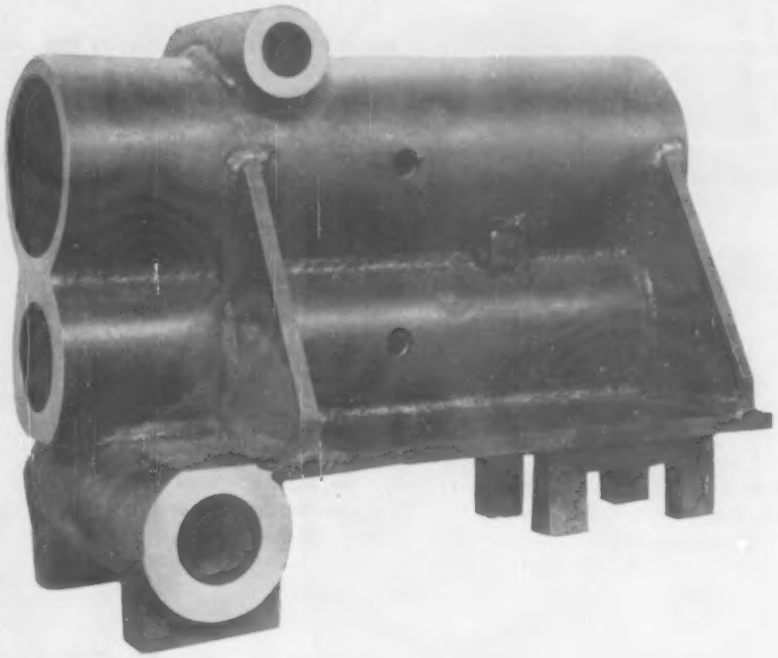
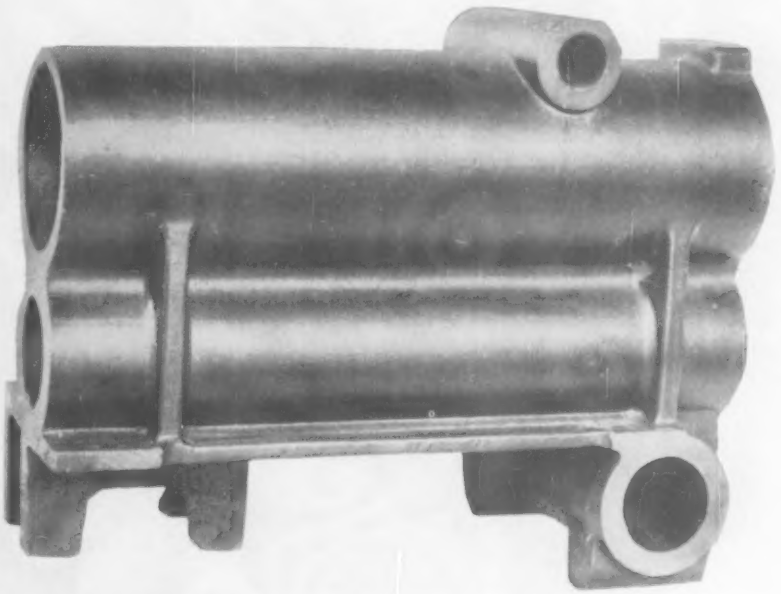


Fig. 18 . . Welded machine tool spindle housing was redesigned for . . .



. . . gray iron to make a better looking component that cost half as much.

simultaneously educating the future design engineers—our customers of tomorrow.

The Foundry Educational Foundation is serving the foundry industry unusually effectively in this same direction by not only providing foundries with well schooled technologists but also with what may be considered a valuable advertising campaign which cannot help but pay dividends in the future.

Another form of advertising which is directed to design engineers, purchasing agents and castings buyers is found in industrial catalogs. Their usefulness is increased because of their great length of life when compared with other forms of advertising. Frequently they serve as the buyers' first source of information for comparing competing products and deciding which companies should be asked to quote on their requirements. As an excellent example, the **Mechanical Catalog** published by the American Society of Mechanical Engineers is typical of several in this group.

Direct Mail has no Substitute

Having prepared a carefully screened list of prospective customers, the direct mail type of advertising in the form of concise, factual engineering letters has proved highly productive based upon actual customer response and interest. A letter of this kind sent once a month is an effective means of keeping the foundry's name before the customer and at the same time furnishing useful information to his engineering staff. Since it contains data of value, it is less apt to be deposited in the conventional circular file—the waste basket.

The same mailing may include a reprint of a recently published advertisement which portrays the application of a casting by some prominent manufacturer already an established customer of the foundry. A highly respected clientele is one of the best recommendations any company can possess. Direct mail advertising should, of course, also be sent to present customers—particularly if it consists of engineering information of value to casting users.

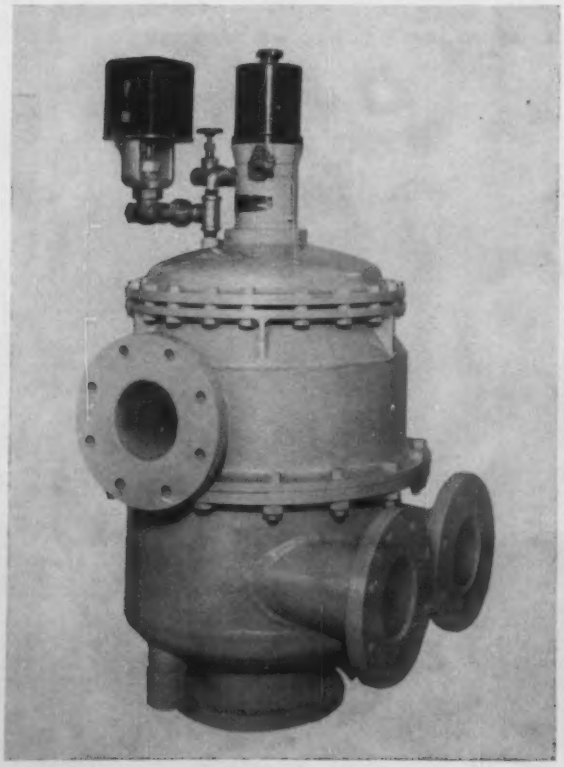


Fig. 19 . . Gray iron saved 70% over fabrication.

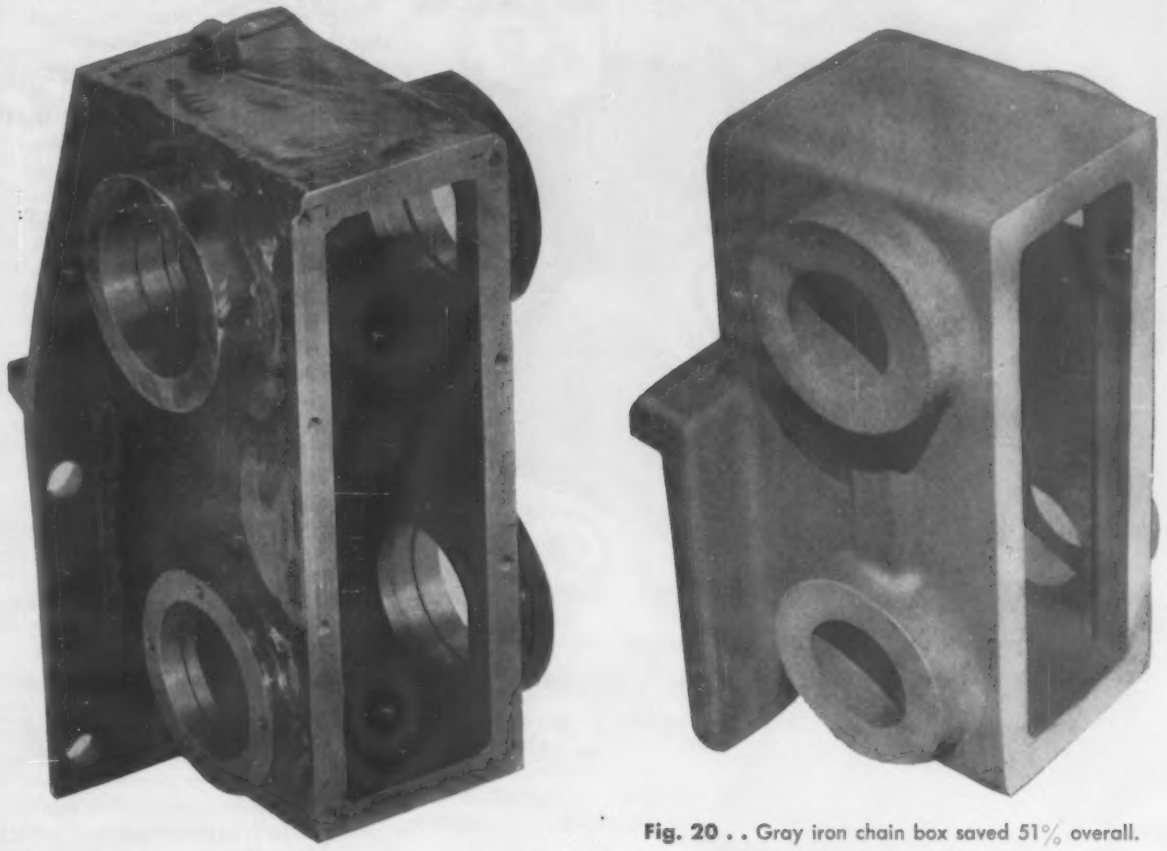


Fig. 20 . . Gray iron chain box saved 51% overall.

Numerous progressive foundries in the past have prepared complete brochures covering their manufacturing facilities, extensive illustrations portraying a variety of castings they have made or have in current production, and specifications of the cast metals they produce. It is the author's opinion that this form of advertising constitutes one of the most profitable for the castings industry. While the original cost is high and requires considerable work and thought, its long term value fully justifies the expense and effort. For a direct mail campaign, it has no substitute.

Seeing is Believing

It has often been said "seeing is believing" and it certainly applies to the foundryman's customer. The casting buyer or design engineer seldom refuses an invitation to a foundry "open house." He is interested in your facilities and how his castings are made. A large percentage of progressive purchasing agents insist on seeing your foundry before they are willing to give you an order. Can you blame them? But, when you do have an "open house" be sure you put your best foot forward. A thorough clean-up and some paint provide the eye appeal many foundrymen have overlooked in the past.

Casting exhibits provide an excellent medium by which the casting producer can make his product known. They are a type of personalized advertising. Until now, a few foundries have exhibited at industrial shows such as the National Metal Congress but these efforts have been sparse. Is there any better way to contact personally a large number of potential customers and especially their design engineers? Thorough consideration should be given various opportunities to exhibit.

An exhibit of typical castings and large pictures of the foundry and its facilities are one form of concrete evidence to convince your potential customer that you are qualified to serve him. Such an exhibit must be manned by foundry personnel qualified to meet with purchasing agents and engineers to discuss their needs and to convince them of the foundry's talent, process control and facilities available to serve them.

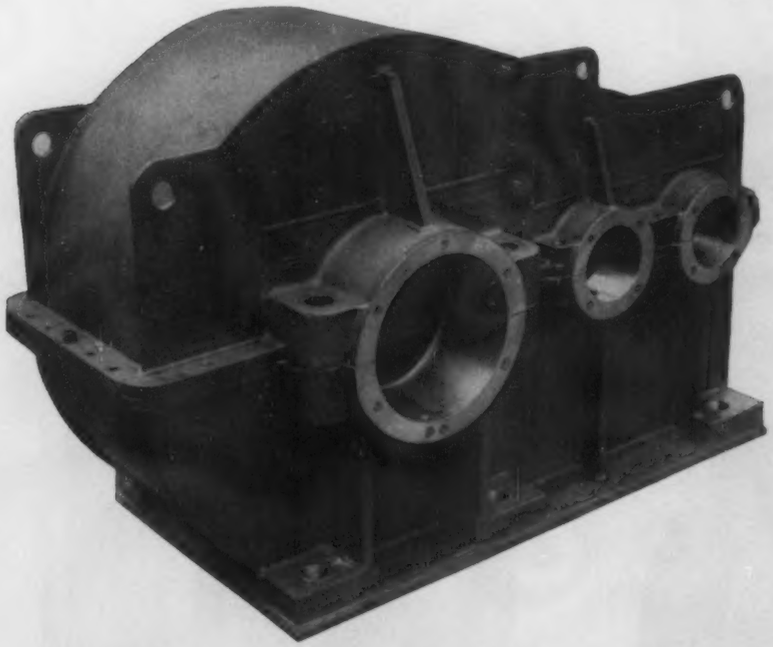
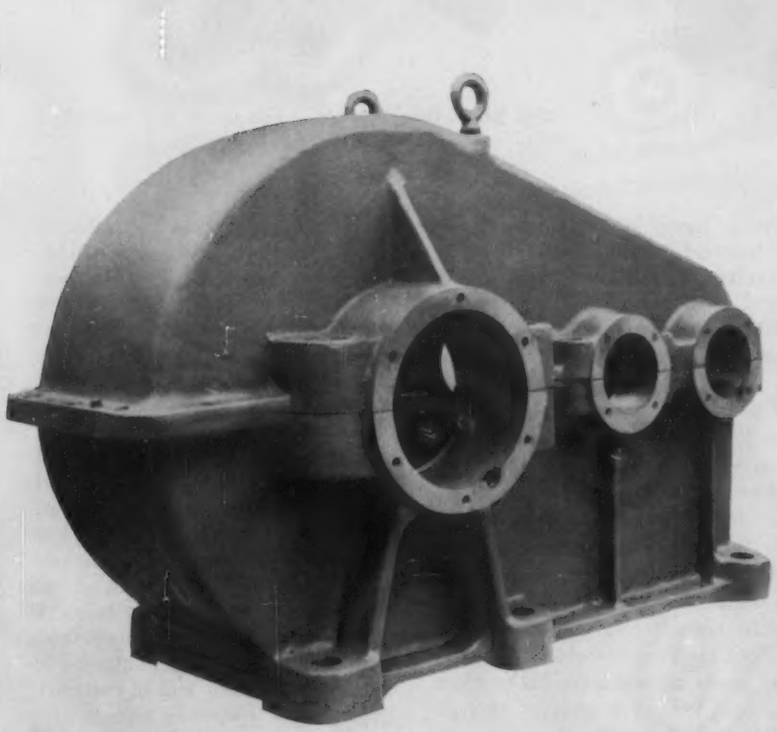


Fig. 21 . . Speed reducer housing fabricated of 69 parts became . . .



. . . two gray iron castings that look better, cost less, reduce noise.

Recently it has been suggested that the exhibits at the Casting Congress and Show, sponsored by the American Foundrymen's Society, be expanded to include foundry castings exhibits in addition to foundry equipment and supplies. By expanding the technical program to include sessions which will appeal to casting users as well as to foundrymen, the Congress can profitably serve a dual purpose and thereby advance the status of the foundryman as well as his customer—a wonderful opportunity for closer liaison so essential to the successful manufacture of castings. When plans have been completed by the American Foundrymen's Society for such an integrated Castings Congress and Show, foundry management should prepare to support it.

■ **Conclusions.** Briefly, it may be concluded that every foundry should have some form of marketing program. The basic principles have been outlined and the extent of such a program can be tailored to suit the needs of every foundry regardless of size.

Most important of all is to know your product; explore and energetically sell it based upon its merits; understand its deficiencies and don't mis-apply them, for to do so hurts the future of your business as well as that of all other foundries. The need for sound castings having high metallurgical quality is evident and its importance will be even greater in the future. Poor design, low strength material not meeting the customer's requirements and especially defects in highly stressed areas are the surest way of losing business.

Management must take an active interest in a sound marketing program and recognize the need for personal contact with existing and potential customers.

Last but not least, there is a need for engineering talent to control established foundry materials and processes as well as develop new improved methods and castings to meet increasing competition.

BETTER POURING means BETTER CASTINGS

There's a ladle or crucible to handle every metal, every mold—choose the right one

EARL SOLOMON / *Ceramic Engineer*
Electro Refractories & Abrasives Corp.
Buffalo, N. Y.

■ Faulty pouring technique is probably one of the major causes of casting defects.

Poor castings sometimes result from air contamination when molten metal is being poured from crucible to mold. To overcome this, the metal must be poured as quickly as possible but with the least possible turbulence. Turbulence is a major factor in gassing, which always causes porous castings.

Revolutionary changes have been made in recent years in crucible spouts to improve pouring. Now rapid-pouring spouts are available in a wide variety of shapes and sizes to fit the specific operation for which they will be used. A spout patterned after that of a coffee pot, for example, is superior for aluminum. It is joined to carbon-bonded silicon carbide ladles below the metal line, and pours a constant stream more rapidly than conventional ladles. Its use eliminates spillage and temperature drops that cause cold shuts in aluminum castings.

A tea pot spout is a natural for bearing bronzes of high-lead composition. This spout pours from the bottom, which is important in keeping slag from flowing into the mold. Another type of ladle features a double spout to allow pouring from either side.

Tilting-type crucible furnaces are generally used in production foundries where large quantities of the same composition of metal are required. In jobbing foundries the flexibility of the lift-out type of crucible is desired where short runs of small castings may require many different metal compositions, or where space does not permit pouring many molds at one time.

With the tilt type, metal is poured from the crucible directly into a smaller crucible which carries the metal to the mold. Sometimes the mold is brought to the crucible on a conveyor for direct pouring. These crucibles, permanently installed in the furnace, are tilted mechanically and generally have large, open spouts. The size of these spouts permits a wide variety of specialized pouring openings to meet requirements.

For best results, the crucible spout opening should be placed as close as possible to the sprue hole, with the mold itself in the best position to facilitate rapid pouring. This might mean revising the handling equipment, but it is generally worth the trouble.

Rigid specifications for castings used in aircraft and electronic equipment has brought to the fore two major problems: the need of proper mold design, and proper quality of metal. Control of this second factor is dependent upon a metallurgical understanding of the

Coffee pot spout pouring crucible in use at Bohn Aluminum & Brass Corp.

Tapping aluminum into oval-shaped 2-spout ladle.

ALUMINUM COMPANY OF AMERICA

Tilting crucible furnace used by students at Purdue.

constituents of the metal, proper melting and pouring, and further treatment called for in the specifications.

Then Came Silicon Carbide

To guard against possible chemical reaction and resultant metal contamination, an improved crucible lining of alumina has been developed for melting high nickel-iron alloys. It is said to take a better glaze and improve bond strength. Cast iron may be melted successfully in an alumina-lined crucible. Linings of fused magnesia, mullite, carbon and zircon also are made for special melting jobs.

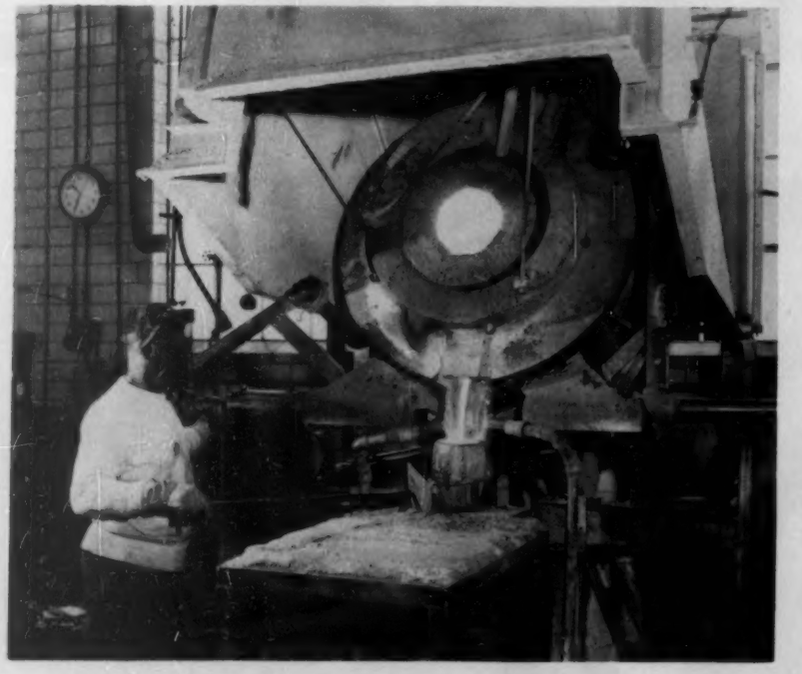
Before silicon carbide was in general use, crucibles usually were made of clay and fireclay or graphite. But around 1915 silicon carbide achieved universal acceptance as a superior heat conductor for refractories. No other material will do the job as well or as inexpensively. Today's most common crucible combines silicon carbide and graphite. The graphite allows a certain amount of flexibility in the finished crucible, permitting expansion of the crucible wall while metal is melting. The silicon carbide and graphite are bonded with carbon bonds which add to the crucible's ability to transfer heat.

The standard crucible of today will undoutedly be replaced by another made of new materials, to a new design, tomorrow. Today, we accept as commonplace many metals which were metallurgical oddities a few years ago and we have only begun to realize what can be accomplished in metal development. New metals to melt means new types of crucibles in which to melt them.

Crucibles Keep Pace

The first crude crucible evolved as a pit whose sides had been built up with clay. As the casting process grew more complex, and as new combinations of metals and alloys created new problems, crucible design was required to keep up to the pace with companion developments. Size, design, and heat resistance were improved. In addition, improved control of chemical reactions of the metal with the crucible itself were developed. In this latter area alone, future developments of importance are to be expected.

CLEVELAND GRAPHITE CO.



Tea pot spout tilting type crucible delivers clean metal from bottom.

Investment Men Look at Vacuum Melting

■ Castings from vacuum-melted alloys cost less than twice the equivalent air-melted castings, F. Kenneth Iverson, chief metallurgist of Cannon-Muskegon Corp., Muskegon, Mich., told the technical session of the Investment Casting Institute at its Spring meeting in New York City in May.

Iverson discussed the economics of vacuum melting for investment casters and described the equipment used by Cannon-Muskegon the development work by the foundry. Investment casts from vacuum melted alloys are superior to wrought vacuum-melted materials, Iverson said.

He described a water-jacketed furnace of 400 lb capacity in which the materials are induction melted. A 300-lb heat can be made and pouring into shell molds, sand molds or other kinds of molds is done under vacuum inside the furnace. The mold is pre-heated to a very high temperature under vacuum, which causes some problems, but there is little change in gating or risering. It is advisable to start out with a base alloy of high purity and know exactly what's going into the furnace, Iverson said.

He compared the advantages of pouring in a chamber surrounded by argon with pouring in a vacuum chamber.

The furnace and power supply don't cost over a few thousand dollars with argon, he said, and a furnace may even be modified to use argon for but a few hundred dollars. However, there is a continuous loss of argon and this is costly. Another problem is that in argon melting it is not possible to evaluate the condition of the melt as in vacuum melting.

Vacuum melting, on the other hand, requires a high capital investment.

Iverson discussed the difficulty of controlling manganese for normal alloys. The metal tends to vaporize all over the inside of the chamber when vacuum melted. He said that nickel-base alloys have been markedly improved but cobalt-base alloys are still questionable.

Cannon-Muskegon uses a zirconium silicate lining. They can pour vacuum-melted castings at four or five microns and can actually get down to less than one micron, Iverson said.

The Institute met in the Hotel New York for a three-day session. The technical session was held on Thursday, May 10.

Geoffrey W. Paget, superintendent of the Precision Casting Department, Deloro-Stellite, Belleville, Ont., Canada, read a paper on *"Production of High Strength Steel Castings."* He also read a paper for Adam Dunlop, director, Shaw Process, Ltd., Newcastle-on-Tyne, England, on *"Methods and Possibilities of the Shaw Process."*

Dr. Nicholas J. Grant, department of metallurgy, Massachusetts Institute of Technology, who is technical director of the Institute, read a paper on *"Decarburization in Investment Casting."*

Hold Gating Clinic

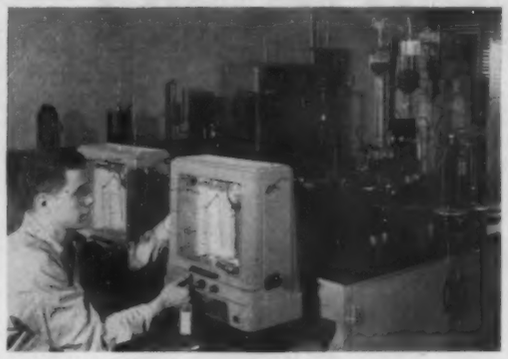
A gating clinic was held with Mr. Paget as moderator. Panel members were P. L. Butler, Arwood Precision Casting Co.; Walter A. Dubovick, Engineered Precision Casting Co.; and Charles Yaker, Misco Precision Casting Co.

Reports were made by Roger F. Waindle, chairman of the Metal Specifications Committee; Roger J. Wilcox, chairman of the Physical and Non-Destructive Testing Committee, and Walter A. Dubovick, chairman of the Process Materials Standards Committee.

The Dimensional Tolerance Committee finalized its work and made its final report on dimensional tolerances which the Institute approved and will publish as a manual.

In business sessions, a review of competitive processes was made, including shell molding, powder metallurgy, and forging. Publicity, advertising and sales promotion of investment castings was discussed and reports read. New research projects were considered and a report was made on forthcoming ICI publications by Robert R. Miller, chairman of the Publications Committee. A round table discussion was held on technical and business problems, with H. P. Dolan, executive director, as moderator.

Core area in Experimental Foundry includes four blowers, sand mixer fed by pneumatic transport system.



Control laboratory of Research Foundry has full facilities for chemical analysis and sand tests.

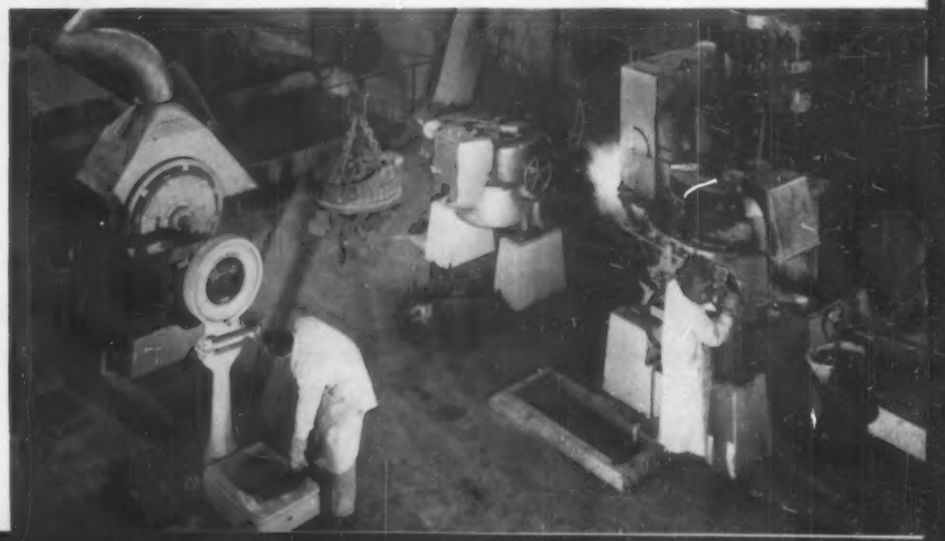
Today Meets Tomorrow in Two Foundries

■ General Motors' $100 million Technical Center, dedicated to accelerating technological progress at ceremonies May 16 at Warren, Mich., 12 miles north of Detroit, looks every bit like a place "where today meets tomorrow." The 330-acre, 25-building Center, is planned around the idea that science is a source of economic energy for industry, the nation, and the world. More than 4000 specialists work in the major sections—Research, Engineering, Styling, Process development, and Service. Facilities include the Experimental Foundry in process Development section and the Research Foundry in the Research section. The Experimental Foundry, designed for pilot production and job shop work, is 120 x 240 ft and can produce an 8-cylinder motor block on a simulated production basis. Ferrous castings up to 2 T can be produced; aluminum castings up to 300 lb and copper-base castings up to 500 lb. The Research Foundry in the 110 x 320-ft Metallurgical Building is designed for more fundamental research. Articles coming out of these foundries include: *"General Motors' Experimental Foundry,"* AMERICAN FOUNDRYMAN, May 1955, pp 110-117; *"Improving Investment Casting Quality,"* AMERICAN FOUNDRYMAN, April 1955, pp 56-61; and *"New Shell Machine Cuts Resin Costs,"* MODERN CASTINGS, May 1956, pp 62-65.

General foundry area of Research Foundry shows all melting equipment well exhausted to control fumes and to keep down the air temperature.

Mass spectrometer is used with vacuum melting furnace equipment (at right) in Research Foundry.

Melting area of Experimental Foundry is served by crane and electromagnet.



HOW DO YOU STORE YOUR PATTERNS?

Here are set-ups for protecting the patterns you ought to keep and for disposing of those you should get rid of

E. J. McAfee
Master Patternmaker
Puget Sound Naval Shipyard

■ Many factors should be taken into consideration when planning a practical and economical storage for wood and metal patterns. Principle factors governing space requirements are:

1. Quantity and volume of patterns on hand.
2. The rate of manufacture or acquisition of new patterns for storage.
3. General rate of obsolescence due to change of design, models, or types of manufactured goods.
4. Types of patterns.

The first two factors as a rule can be ascertained easily. It is usually the third factor that calls for a little crystal gazing.

Plants which store their own patterns tend to keep them a long time after they have become obsolete, due perhaps to the thoughts of their original costs or the bare chance they may be needed for replacement castings. When good judgment is used in the destruction of obsolete patterns, the replacement costs can be held to a minimum and need be but a small fraction of the storage costs.

The rule to use to eliminate the old and obsolete patterns must necessarily be determined by the individual plant's problems, governed by their rate of obsolescence. One large plant is using the following method:

1. When the pattern is made for only a one-off job and is manufactured as cheaply as possible, it is then destroyed, after the casting has been tested, machined, and installed.
2. All patterns pertaining to a piece of machinery which has suddenly become obsolete are destroyed immediately.
3. Patterns that have been in storage for five years without being used are destroyed with the following exception. Small expensive and intricate patterns that have a possibility of further use are kept another five years before destruction.
4. After ten years of storage all patterns are destroyed that have not been used during the preceding five years and are not in current use. Of course there will be exceptions to every rule, when cost

J. M. KREINER, NATIONAL MALLEABLE & STEEL CASTINGS CO.

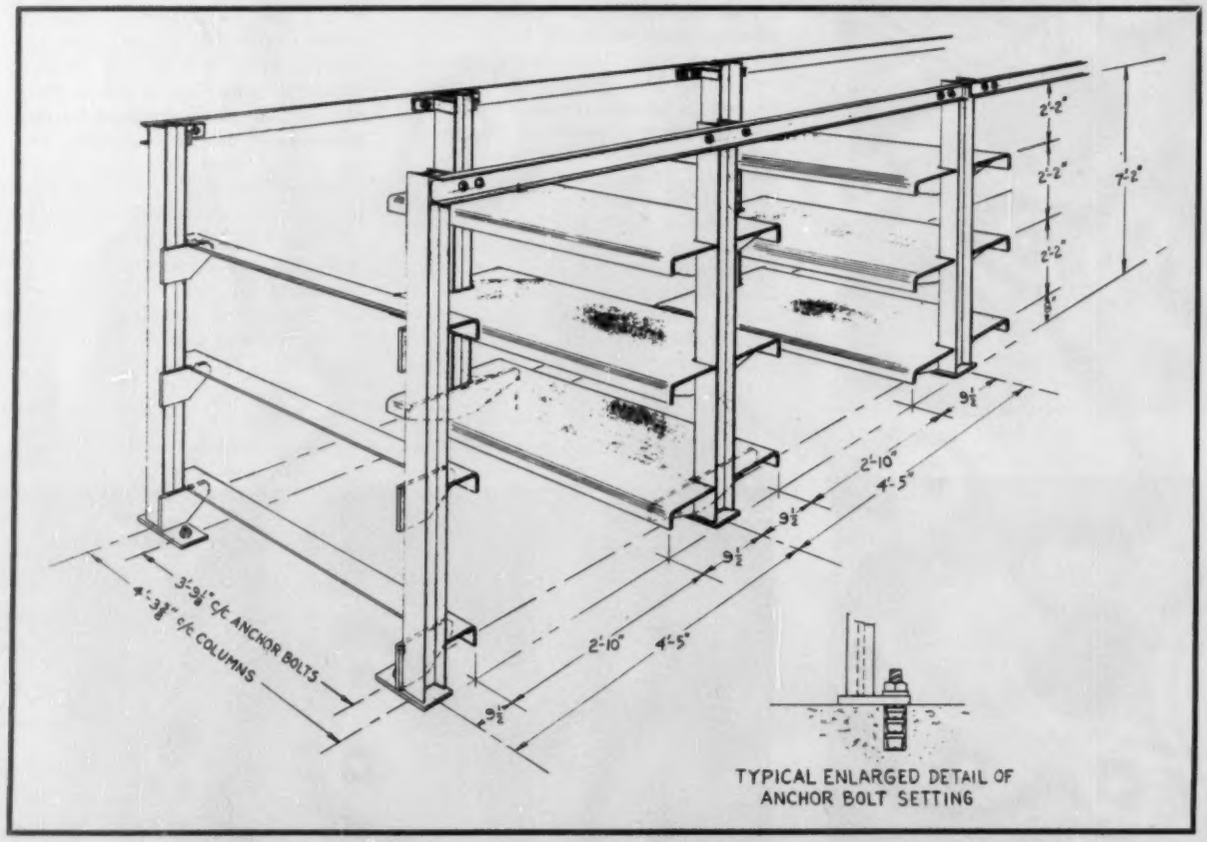


Fig. 1 . . Large, heavy patterns which remain on plates are handled by lift truck with this type of storage rack.

of replacement, storage cost, rate of use in the past, and the possible as well as the probable use in the future are taken into consideration.

As ground space and building costs, as well as maintainence, enters into the cost of storage, it is well to keep in mind that excess storage facilities also add to plant expenses such as heating, taxes, and insurance.

■ **Weatherproof storage** should be provided with good temperature and humidity control. The type of building naturally will be governed by the seasons usually encountered in the locality.

Both cheaply built and expensive hardwood patterns may deteriorate to a total loss in weatherproof buildings, if heat and humidity are not controlled. The heat and humidity in storage areas should be kept as near as possible to that in which the patterns are manufactured.

Lumber stored in the pattern shop for six months or more usually absorbs the moisture of the air surrounding it. Some lumbers will take from one to three years to dehydrate to the moisture content of the surrounding area, dependent on the amount of air circulation. It generally takes about one year to air dry each inch of lumber thickness.

Therefore, if pattern material with 8 percent moisture content is used to manufacture a pattern, then the moisture content of the air in its permanent storage space should be maintained as near as possible to that level. If the moisture content of the air in storage goes to 14, 15 percent, or over, the pattern stored in this area may distort through warpage or expand to such a degree as to make it useless for further use. Conversely, when the humidity of the storage space is below that of the material at the time of manufacture the pattern will shrink and distort as well as separate at the glued joints.

All storage spaces where wooden patterns are stored should be provided with an adequate automatic sprinkling system. This will reduce the cost of insurance and will be a great factor in minimizing the loss in case of fire, especially so, when insurance is not provided.

■ **Shelving**, under all circumstances, should be of metal, not only for strength but as a safety factor against fire or collapse. Two types of storage for large and heavy patterns mounted on molding plates are shown in Fig. 1 and 2. Figure 1 shows a practical type of storage where the patterns can be handled with a lift truck. Obviously, the patterns must remain on the molding plate during storage.

Figure 2, a rack arrangement for storage of less active patterns, contains room for two standard sizes of pattern plates. The patterns are again left on the molding plates, which are lowered into place on the rolling tables between the aisles of the racks. These racks are served by an overhead bridge crane. After the crane places the pattern and plate into position, it is rolled sideways into its storage place on the roller conveyors that are part of the rack. Being stored on roller conveyors, it is necessary to provide a suitable locking arrangement to prevent the plates from slipping out of their storage place due to possible vibration of the racks.

These types of racks adjacent to or in the foundry are quite satisfactory for large active patterns.

Figures 3 and 4 show typical metal shelving that can be knocked down for portability and shelf spacing. This type of shelving is adaptable to small metal or wood patterns that can be manually handled and need no power handling arrangements. The types of shelving and the amount of floor space allowed for large patterns not

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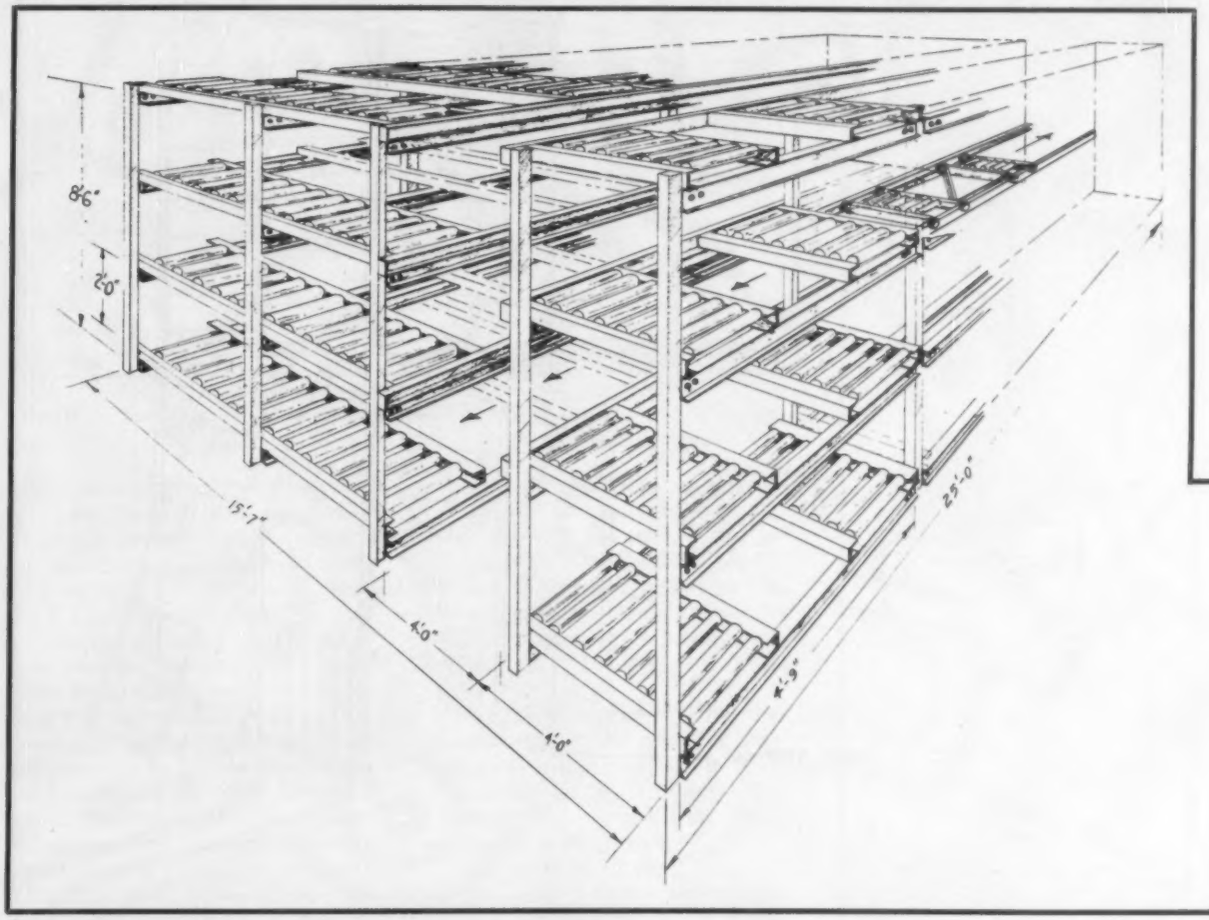


Fig. 2 . . Rack for less active heavy patterns mounted on plates includes roller conveyor shelves and roller conveyor bridge across aisle.

U. S. NAVY PHOTO

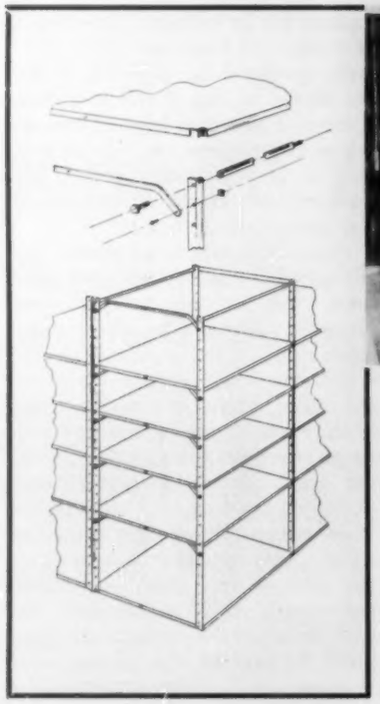


Fig. 3 . . Knock-down shelving for small patterns that can be manually handled takes minimum space, gives storage flexibility.

adaptable to being shelved should be governed by the needs of the individual foundry or pattern shops.

■ **Pattern identification** may be done by many systems of numbering. Some systems use the straight consecutive type of numbers from 1, 2, 3, and on ad infinitum. Others may use the plan and item number. Others may also include the year in either of the above systems. The most efficient method of numbering a pattern is the one which most readily identifies the pattern with its end usage. A simple and practicable method is a cross file system, using the consecutive number for each pattern as manufactured.

The duplicate pattern record card shown in Fig. 6 has blank spaces for all pertinent data to be typed in at the time the pattern has been checked and orders written to the foundry for the castings required. It will be noted that the information to be placed on this card, besides the pattern number, includes the name of the pattern and/or the object for which it is to be used, the location in the loft, the date of manufacture, for what purpose, the customer, the type of

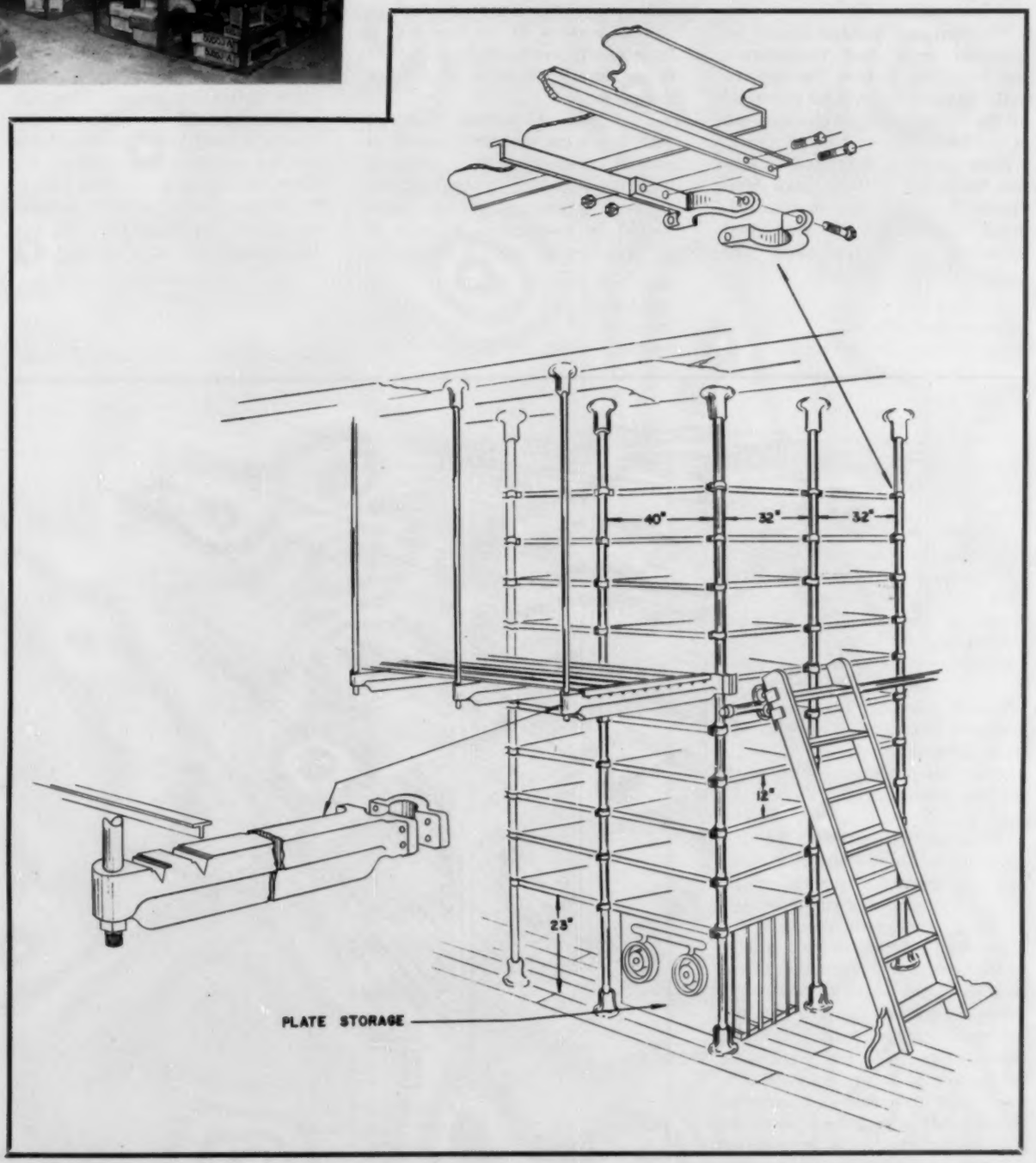


Fig. 4 . . Two-story pattern storage has adjustable shelving, is easily erected and altered to meet changing needs.

Fig. 5 . . Storage for bench and squeezer patterns at left. In center is equipment for 750-lb rollover; at right, for 6000 and 10,000-lb rollover.

DATE	PATTERN NUMBER	LOCATION
3-15-52	50415	2-2-1-E20
NAME: Front Section		
FOR: Furnace		
SHIP: Plate Shop	MATERIAL: Cast Iron	
DRAWING: 1109455	PATTERNS: 1	
ITEM(S): 315	BOXES: 1	
1 core		
MAR 15 1952		
FEB 13 1953		
JAN 11 1954		
APR 1 1955		

PATTERN RECORD

DATE	PATTERN NUMBER	LOCATION
3-15-52	50415	2-2-1-E20
NAME: Front Section		
FOR: Furnace		
SHIP: Plate Shop	MATERIAL: Cast Iron	
DRAWING: 1109455	PATTERNS: 1	
ITEM(S): 315	BOXES: 1	
1 core		

Fig. 6 . . Double pattern record card used by Pudget Sound Naval Shipyard.

cast material or its symbol, the plan and item number, number of duplicate patterns, and the number of core boxes. The above information is typed in duplicate upon each half of the card.

The spaces below this information are provided for the date each time the pattern is sent to the foundry for additional castings. This historical data is priceless when determining the future value of the pattern during a survey for possible destruction due to possible obsolescence and needed storage space. With the available data now placed on both halves of the pattern record card the two half cards are separated and sent to the pattern loft for filing.

One card is filed in its numerical order on one side of the drawer (Fig. 7) while the other duplicate card is placed in the cross file according to the type and nature of the equipment on which it is used with such heading as pumps, propellers, impellers, arresting gear, etc.

To establish the storage location of each pattern the available storage space is first divided into suitable areas on each floor of the building (Fig. 8) with the areas numbered consecutively.

Each area is divided into two sections with a center access aisle running between the two sections. The shelving can then be erected in double rows, at right angles to

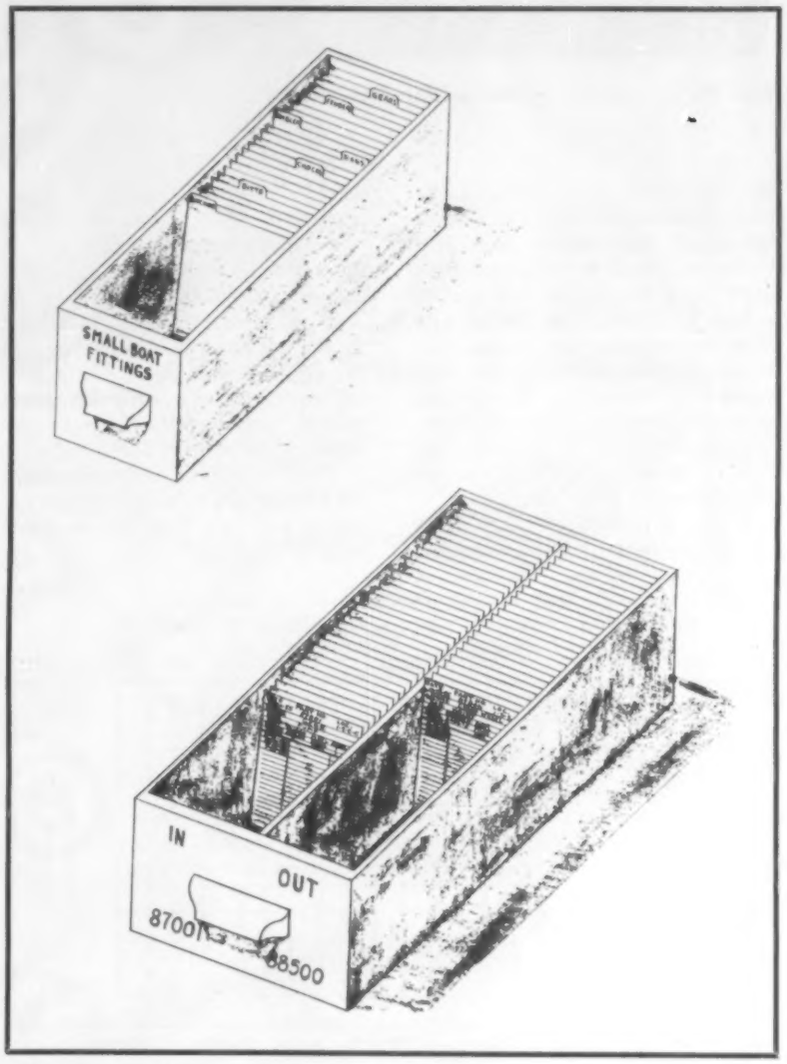


Fig. 7a . . Half of record card goes into each file as cross-reference.

U. S. NAVY PHOTO

Fig. 7b . . Author McAfee quickly finds pattern card filed as described.

the access aisle. Each row is identified alphabetically with the shelves numbered numerically (Fig. 3B). Under this system, a pattern having 2-2-1-E-20 as a location symbol would be located on the second floor, second area, first section, row E on shelf twenty. The location symbol is painted on the pattern as well as being typed on its identification file card, to simplify the task of returning it to the proper storage space after use.

When a pattern is taken from the loft to be sent to the foundry, its file card in the main file is removed from the left hand side of the drawer, dated, then placed in the right side (Fig. 7A). When it is returned from the foundry to the loft, the card is then placed back in the left hand side of the drawer. At a glance, the location of any or all patterns can readily be determined, whether they be in the foundry or storage loft.

This system can easily be adapted to all types or shapes of storage areas with any type or combination of shelving.

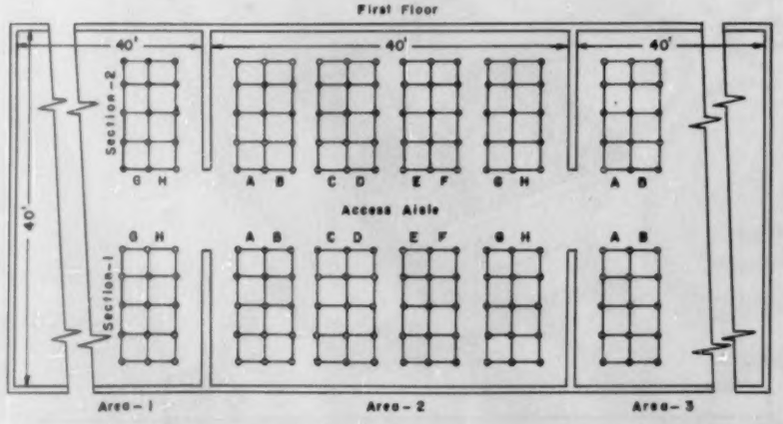


Fig. 8 . . Floor plan identifies pattern location given on record card.

FEMA Hears Business to Remain High

■ Business in general, and the purchases of industrial equipment especially, continue at high levels and seem likely to remain so, members of the Foundry Equipment Manufacturers Association were told at the organization's spring meeting May 25 in Washington, D.C.

Indications of the high level of equipment purchases by industry, including foundries, were given both by Ewan Clague, Commissioner of Labor Statistics, and Einar Borch, National Metal Abrasive Company, who is chairman of FEMA's statistical committee.

Mr. Clague produced charts which showed that farm products prices are one of the few weak spots in the economy and they have strengthened somewhat in the past four or five months. Housing starts are off somewhat from 1.4 million in 1955 to an estimated 1.2 million in 1956 and another five to 10 per cent dip is expected in automobiles between June and October. But the price of used cars has gone up and economists interpret the automotive production slump and the high activity in used cars to mean that potential buyers are waiting for the new automobile models in the fall, when complete redesigns are expected.

No Downturn

"No one sees in sight a major business downturn but instead is a levelling off which may represent a consolidation," Mr. Clague reported. "Personal consumption expenditures, government, business expenditures and inventories show no sign of declines."

The greatest single strength is in business purchases—raw materials, semi-finished goods, continued purchases of capital goods, new equipment and so forth by industries themselves. Prices are also highest in these areas.

Mr. Borch also sounded an optimistic note for the continued high levels of capital goods purchases by industry, including the castings industry. For capital goods as a whole, the Federal Government estimates are up 22 per cent in 1956 over 1955—a total of $34,893 million. Of this amount, anticipated capital expenditures for the primary metals segment, which includes the castings industry, total $1,745 million.

While these figures do not distinguish between what's being spent for new construction and what for machinery and equipment, historically, new structures have been 25 to 33 per cent of the total and equipment and plant 67 to 75 per cent of the total.

Industry Spending

The $1,745 million estimated expenditures for the primary metals industry represents a gain of 62 per cent over 1955. Despite the decline in the motor vehicle industry during the early months of 1956, Borch explained that capital expenditures of the industry were predicted to be 65 per cent above 1955.

Borch believes that the figures quoted by the Government are conservative. They are extremely factual for past business and for the two quarters ahead include only those expenditures which have actually been committed.

The FEMA meeting was held at the Sheraton-Carlton Hotel. It was chairmanned by D. E. Davidson, Link-Belt Company, who is president of the Association. During the morning program meetings were held by the dust and fume group, furnace group, material handling equipment group and molding machines group. W. B. Harris, of the Atomic Energy Commission, New York, and J. T. Melichar, general plant engineer of Johns-Manville Corp. spoke to the dust and fume group.

Niels A. Olsen, deputy director of the metalworking equipment division, Business and Defense Services Administration, described the administration's mobilization preparedness program. He praised the advances in productivity seen at the 60th AFS Castings Congress.

Guests included Russell Belleza, assistant administrator of the metalworking equipment division of BDSA; Robert Fleming, branch chief, and Harry Hawkins, branch chief.

Heat Treating Gray Cast Iron

■ Gray iron has been called steel plus graphite and, like steel, can be strengthened and hardened by quenching from above the upper critical temperature followed by tempering.

A. H. Rauch, senior metallurgist, and J. B. Peck, metallurgist, materials engineering department, Deere & Co., Moline, Ill., recently explored the hardenability of both alloyed and unalloyed irons in the strength range of ASTM Class 25 to Class 35, as well as the effect on hardenability of chromium, nickel and molybdenum singly and in combination. Their findings were presented at the AFS Castings Congress at Atlantic City in May.

The metal matrix of gray iron is essentially a high-silicon, medium-carbon steel. Like steel, an upper critical temperature must be exceeded in order to secure a uniformly hardened structure. Unlike steel, however, the carbon content of the metal matrix is dependent upon time and temperature employed in heating for hardening because of the presence of excess carbon in the form of graphite. In order to consistently harden satisfactorily the full range of compositions of the Class 25 to Class 35 irons investigated, all samples were heated to 1600 F and soaked at temperature for 30 minutes.

Findings included the following:

■ Gray cast iron will respond uniformly and satisfactorily to heat treatment within the limits of a suitable range of section size commensurate with its hardenability.

■ Chromium, nickel and copper when used singly do not affect hardenability appreciably. Molvbdenum by itself raises hardenability only moderately but when used in combination with nickel is very effective in increasing hardenability.

■ The Rockwell C hardness test does not indicate the actual hardness of the metal matrix in either the quenched or the tempered condition.

■ The as-quenched matrix responds to tempering in the same manner as 0.50 per cent to 0.60 per cent carbon, 2 per cent silicon steel.

■ Gray iron in the as-quenched con-

dition has lower strength and impact resistance than the as-cast iron.

- Impact resistance and deflection values in the transverse bend test are restored to the as-cast level by tempering at 600-800 F.
- The transverse bending strength is restored to as-cast by tempering at a minimum of 500 F. After tempering at 600-900 F these values are on an average of 10 per cent above the as-cast values.
- On tempering at 400 F the tensile strength is appreciably above the as-cast strength. A peak in tensile is reached on tempering at 600-800 F with values from 38 per cent to 72 per cent above the as-cast values.
- The secant modulus of elasticity is decreased slightly by heat treatment.

Announce Regionals

Eleven regional conferences have been announced by the American Foundrymen's Society. Dates and locations are:

Sept. 26-28 . . *Missouri Valley Regional Conference*, Missouri School of Mines, Rolla, Mo.

Oct. 19-20 . . *New England Regional Conference*, Massachusetts Institute of Technology, Cambridge, Mass.

October 19-20 . . *Northwest Regional Conference*, Seattle, Wash.

October 25-26 . . *Purdue Metal Casting Conference*, Purdue University, West Lafayette, Ind.

Nov. 8-9 . . *All-Canadian Regional Conference*, Montreal, Que.

Nov. 29-30 . . *Michigan Regional Foundry Conference*, University of Michigan, Ann Arbor, Mich.

Feb. 14-15 . . *Wisconsin Regional Foundry Conference*, Milwaukee, Wis.

Feb. 21-22 . . *Southeastern Regional Foundry Conference*, Birmingham, Ala.

Mar. 8-9 . . *California Regional Conference.*

April 12-13 . . *East Coast Regional*, Philadelphia.

June 20-22 . . *Penn State Foundry Conference*, Pennsylvania State University, University Park, Pa.

for the asking

Sand system lets one man handle the preparation, aerating, and delivery of sand to four molding stations. Four-page "Molder's Helper" gives the salient details in text and pictures. *National Engineering Co.*

CIRCLE NO. 57, PAGE 13-14

Shell core unit detailed in Bulletin 6005 is fully automatic and will turn out 300 complete cycles per hour. With multiple core box equipment, this means up to 1200 shell cores per hour. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

CIRCLE ON. 58, PAGE 13-14

Electrolytic chromium and manganese that is 99% pure is described in 4-page illustrated folder that gives properties and uses for ferrous and non-ferrous applications. *Electro Metallurgical Co.*

CIRCLE NO. 59, PAGE 13-14

Shell mold system able to produce 240 quality molds per hour is described in Book 2462. System includes

4-station molding machine, shell closing machine, and allied process equipment. *Link-Belt Company...*

CIRCLE NO. 60, PAGE 13-14

Brass casting defects make up the lead article of the May issue of *Foundry Practice*. Other articles: how design is affected by foundry practice; aluminum sand casting defects; pyrometry in the foundry. *Foundry Services, Inc.*

CIRCLE NO. 61, PAGE 13-14

Process instruments covered in 2-page booklet GEC-1362A include indicators, recorders, and controllers. Ranges, dimensions and mountings are included. *General Electric Co.*

CIRCLE NO. 62, PAGE 13-14

Core paste in ready-to-use form is presented in 2-page folder. The paste comes in drums or cans, is dispensed through pump or molasses gate. *M. A. Bell Co.*

CIRCLE NO. 63, PAGE 13-14

Organolithium bibliography now has four supplements, the latest for works published on the use of organolithium compounds in organic synthesis in 1954 and 1955. This makes a total of 1021 abstracts reviewed since 1949. *Lithium Corp. of America.*

CIRCLE NO. 64, PAGE 13-14

Cold-setting binder described in 6-page folder designated Bulletin GES-2 needs no ramming, half as much rodding, cuts baking time, gives uniform hardness and accurate dimensions. *G. E. Smith, Inc.*

CIRCLE NO. 65, PAGE 13-14

Cutoff machines, creep testers, and many other items are presented in 8-page "AB Metal Digest", May issue. Some pictures, but mostly descriptions. *Buehler Ltd.*

CIRCLE NO. 66, PAGE 13-14

Nickel and the role it plays in cast bronze is told in 8-page article reprinted from *Canadian Metals*, April 1950 issue. *The International Nickel Co., Inc.*

CIRCLE NO. 67, PAGE 13-14

Industrial presses, both hydraulic and pneumatic, are shown in 16-page Bulletin DH-486. Ten models with capacities from 25 to 150 tons are specified in detail. Capabilities and accessories are incorporated in tabular form. *Manley Div., American Chain & Cable Co., Inc.*

CIRCLE NO. 78, PAGE 13-14

Fork truck with 3000-lb capacity is detailed in 4-page folder containing installation and product pix, engineering drawings, full specifications. *Elwell-Parker Electric Co.*

CIRCLE NO. 79, PAGE 13-14

Adhesive bonding at room temperatures is covered in 8-page illustrated technical reprint. Techniques and precautions, advantages and disadvantages are pretty well spelled out. Graphs and tables give useful data. *Rubber & Asbestos Corp.*

CIRCLE NO. 80, PAGE 13-14

Moisture proofer for concrete and cement materials is discussed in one-page bulletin, giving characteristics and applications. *Pennsylvania Industrial Chemical Corp.*

CIRCLE NO. 81, PAGE 13-14

continued on page 73

Conference Chairman Elmer Braun (right) presided throughout meeting. Technical Director Jim Lansing discussed MFS research.

Malleable Founders Hold First T & O Conference

■ Molding methods and pearlitic malleable production highlighted the first Technical & Operating Conference of the Malleable Founders' Society held at Wade Park Manor, Cleveland, May 24 and 25. Designed to promote interchange of experiences on every day production problems and to provide information on new and future developments, the conference provided an open forum for top manufacturing executives, department heads, and operating personnel.

Conference chairman was Elmer E. Braun, Central Foundry Div., General Motors Corp. He headed the program committee including George J. Behrendt, Eastern Malleable Iron Co., Robert V. Osborne, Lakeside Malleable Castings Co., and Ernest J. Stockum, Dayton Malleable Iron Co.

Pearlitic malleable has opened new markets and created a new awareness of both standard and pearlitic malleable as engineering materials, John A. Wagner, Wagner Malleable Iron Co., said in introducing a symposium on pearlitic malleable. Panel members spoke following the conference opening by MFS President Carl L. Liebau, Federal Malleable Co.

Walter M. Albrecht, Chain Belt Co., outlined his company's practice for producing pearlitic malleable by alloying with manganese and copper. In a heat treat cycle of about 69 hours, the castings are air quenched to get fine pearlite, then are spheroidized, he said.

Reheat-treat pearlitic malleable is

James H. Smith outlined GMC Central Foundry Div. objectives.

On maintenance of molding machines and mold blowing, Ed Wareing (left) and F. B. Rote.

Molding panel leader and a conference planner was Bob Osborne of Lakeside Malleable.

fully malleablized, then reheated and quenched to get a pearlitic structure, followed by tempering to relieve quenching stresses and to develop desired ductility, George T. Boli, Northern Malleable Iron Co., stated. He recommended development of more information on heat treatment of pearlitic malleable to give to customers and commercial heat treaters who often spoil good pearlitic malleable in attempts at further heat treatment.

Heat treat cycle for arrested graphitization pearlitic malleable is 18.3 hours (29 for standard malleable) at Wagner Malleable Iron Co., according to Lyle R. Jenkins. A pusher type continuous radiant tube furnace with zonal temperature control is used, he said.

Process control of pearlitic malleable is essentially the same as for standard malleable, differing only in detail, W. Truckenmiller, Albion Malleable Iron., pointed out. He described the practice used at Albion for cupola-air furnace duplexing. Excess chromium is counteracted with ferroboron additions in the bull ladle, he said. Bismuth-boron additions are used to combat inverse chill which is noted more frequently in shell molds.

In a discussion of automation in green sand molding, W. G. Ferrell, Auto Specialties Mfg. Co., described a setup using two automatic 2-station machines to produce a 30 x 40-in. mold every 17 seconds. One man controls both machines from any of several remote control stations.

Anyone planning on an automatic molding installation should also plan

on a longer period of adjustment and break-in than they anticipate, C. H. Lambert, Eberhard Mfg. Co. Div., Eastern Malleable Iron Co., said in reporting on his company's $435,000 installation. Surface finish and scrap record are better than in the rest of the foundry, he said. The unit turns out 300 molds an hour and is adaptable to short runs since a pattern can be changed in two minutes.

A panel discussion of diaphragm molding by Paul Winters, General Electric Co., and Lon Ulsenheimer, National Malleable & Steel Castings Co., was led by Robert V. Osborne, Lakeside Malleable Castings Co. Winters showed a film of his company's practice. Enough experience had been gained to indicate that the process has considerable promise, he stated. He was able to use heavy-duty, quick-release magnesium flasks.

Ulsenheimer said he had found that it was possible to change patterns quickly and that the equipment needed very little pit.

Blow-squeeze molding saves time in getting sand into the flasks, but so far he hadn't found it possible to blow a mold sufficiently hard to eliminate squeezing, F. B. Rote said of the blow-squeeze stack molding operation at Albion Malleable Iron Co. Best production to date is 168 stacks of 10 cheeks per machine per shift, he said. He described a blowability test devised at Albion to evaluate molding sands for the equipment (*"How to Measure Molding Sand Blowability,"* AMERICAN FOUNDRYMAN, June 1955, pages 78-81).

A preventive maintenance program briefed by Ed Wareing, Texas Foundries, Inc., included:

1. Secure complete data on equipment, motors, etc., at time of installation.
2. Get a list of recommended spare parts for a two or three year period and get the spares at the time of installation.
3. Issue instruction tickets to the maintenance department for work to be done. Number the tickets serially so none can be overlooked.
4. After records show that some part of an installation will last a certain time, replace it before the usual life span to avoid downtime.

The morning of the second day was devoted to shell molding under the chairmanship of George J. Behrendt, Eastern Malleable Iron Co. Hugh Pope, Eastern Malleable, described a small jobbing operation and showed examples of castings made in shells for one or more of the following reasons: eliminate rough machining, eliminate cores and core setting, get more castings per mold, minimize

shift, to get precision in high-chromium difficult-to-machine steel.

Carl Schopp, Link-Belt Co., outlined experiences with a medium-sized installation, an integrated unit with a four-station rotary machine producing 180 molds per hour. He said it had been necessary to allow shell molds to stand twice as long as the same castings in green sand prior to shakeout. A sound-color movie illustrated his remarks about the integrated unit.

The high production shell molding operation at the Saginaw Malleable Iron Plant of General Motors was described by Joe Orloff. He covered both the dump and the blow-hot press method of making shells (*"New Shell Machine Cuts Resin Costs,"* MODERN CASTINGS, May 1956, pp 62-65).

In a luncheon address, James H. Smith, Central Foundry Div., General Motors Corp., outlined some of his organization's objectives and illustrated the steps being taken to achieve them by means of a sound-color motion picture, *"To Meet the Challenge."* He was introduced by Lowell D. Ryan, MFS managing director.

A summary of MFS gating and feeding research findings to date was presented by James H. Lansing, technical and research director.

Development work and production uses of the CO_2 process were covered, respectively, by B. C. Yearley, National Malleable & Steel Castings Co., and Hans Jacob, Lehigh, Inc.; E. J. Stockum, Dayton Malleable Iron Co., was chairman of the session. Yearley said he'd never seen a scab or wash caused by a CO_2 core, and since the sand doesn't pack densely it gives a minimum hindrance to contraction. However, you will not get ease of shakeout unless organic additives are used, he stated.

Lehigh, Inc., is now making 75 per cent of its cores by the CO_2 process, Jacob said. After almost a year, no harmful effects due to Na_2CO_3 build-up have been encountered. He gave as a mixture: Mix 300 lb of New Jersey silica sand (AFS grain fineness 75) and 3 lb of seacoal dry for one minute; add 3 lb of syrup and mix an additional two minutes; finally add 12 lb of sodium silicate and mull another two minutes. Keep the sand above the CO_2 outlets (carbon dioxide is a heavy gas) and you can keep the mix as long as two hours.

In the final session, O. K. Hunsaker, Ironton Malleable Div., Dayton Malleable Iron Co., urged the use of gamma ray sources such as cobalt 60 and iridium 192 for developing production techniques that assure sound castings.

foundry trade news

WaiMet Alloys Co. . . is a new division of Consolidated Foundries and Mfg. Co. Consolidated has acquired certain assets of WaiMet Eng. Co. and merged them with the Michigan-Standard Alloy Casting Co. Headquarters of new master alloy producer will be in Detroit. Roger F. Waindle, president of WaiMet Eng. Co., becomes president and general manager of WaiMet Alloys.

U. S. Electrical Tool Co. . . Cincinnati, Ohio, manufacturer of portable electrical tools, grinders and buffers, purchased the manufacturing rights, dies, fixtures, and inventory of the portable tool line of the Bradford Machine Tool Company.

Alloys Foundry Co. . . Chicago producer of nickel, high nickel, and stainless steel castings, has been purchased by C. K. Faunt. He will also continue as manager of Christensen & Olsen Foundry Co.

Lebanon Steel Foundry in Lebanon, Pa., firm has recently published the case histories of two aircraft steel castings now in production using Lebanon's Ceramicast process.

Commercial Shearing & Stamping Co. . . company operating gray iron and brass foundries in Youngstown, Ohio, has joined American Foundrymen's Society. T. C. Kane is chief engineer of organization that includes pattern and machine shops.

Hitchiner Mfg. Co. . . plant addition being built by Milford, New Hampshire, plant will permit increased production of investment castings.

Alloy Precision Castings Co. . . Cleveland, Ohio, investment caster will consolidate operations in new 23,000 sq ft plant at 3855 W. 150th St., Cleveland.

Eastern Malleable Iron Co. . . Naugatuck, Conn., firm has set a new safety record by going through over 1,750,000 man hours in 1954, 1955, 1956 without a single lost time injury.

General Refractories Co. . . has announced plans for a new basic refractory brick manufacturing plant at Gary, Ind.

Vanadium Corp. of America . . has started construction of a plant for production of ferro alloys at New Alexandria, Ohio.

Electro Metallurgical Co. . . has poured off the first heat of titanium metal sponge at its Ashtabula plant.

Thor Power Tool Co. . . has opened a factory sales and service branch in Kansas City at 606 W. 17th St. E. C. O'Connell is manager of the branch.

Southwood Machinery Sales . . Indianapolis supplier has been named exclusive distributor for Erie Strayer clamshell buckets in southern Indiana.

Le Roi . . division of Westinghouse Air Brake has announced a $5.5 million expansion in engineering and research facilities at its Milwaukee plant.

Neville Ferro Alloy Co. . . is a new wholly-owned subsidiary of Pittsburgh Coke & Chemical Co. which will produce and market ferro-manganese and other ferro-alloys.

Mid-Continent Steel Casting Corp . . Shreveport, Louisiana, steel foundry has joined the American Foundrymen's Society.

S. Obermayer Co. . . has announced formation of a subsidiary, Esso-Ramtite Co., to manufacture materials for Obermayer's operating divisions: Obermayer and Ramtite. The new

subsidiary will construct a plant near Portsmouth, Ohio.

Tronic Corp. . . . Sinclair Collins Valve Co. division has joined the American Foundrymen's Society. Vernon Taylor is superintendent of this Akron, Ohio, brass and bronze plant.

Harvill Corp. . . . Los Angeles die casting firm has acquired 30 acres of land in Santa Ana, Calif., and will build a 125,000 sq ft plant that will increase productive capacity 70 per cent.

Investment Casting Co. . . . Springfield, N. J., firm has published a guide to the advantages and applications of investment casting techniques.

Caterpillar Tractor Co. . . . the seventh U. S. plant of this company has been opened in Decatur, Ill. The new operation covers 840,000 sq ft and employs 3,200 people.

Beloit Eastern Corp. . . . Downington, Pa., gray iron plant has joined the American Foundrymen's Society.

Empire Steel Castings, Inc. . . . designation charts for heat resistant and for corrosion resistant stainless steel castings have been published by this Reading, Pa., company. The charts correlate ACI, AISI, and ASTM designations.

Ilg Electric Ventilating Co. . . . celebrated its 50 years in business with an open house at its Chicago plant.

Garrett Supply Co. . . . Los Angeles organization has been named to distribute Norton grinding wheels and the products of the Chain Belt Co.

Gardner-Denver Co. (Canada), Ltd. . . . has opened a new district sales and service office in Winnipeg at 1400 Sargent Ave.

Norton Co. . . . has opened its new grinding wheel plant at Santa Clara, Calif.

Pressure Match Plate Co., Inc. . . . Philadelphia firm has joined the American Foundrymen's Society.

Stulz-Sickles Co. . . . Newark, N. J., manganese-nickel steel producer has started construction of a plant at Elizabeth, N. J.

Cooper Alloy Corp. . . . has announced expansion of its facilities at Hillside and Clark Township, N. J.

Beryllium Corp. . . . has opened a new warehouse at 17187 Wyoming Ave., Detroit, Mich.

Supplier to Casting Industry Celebrates 125th Year

The Philadelphia Quartz Company, producer of soluble silicates for use in the metal castings industry, is celebrating this year its 125th anniversary.

In observation of their 125 years of continuous business, the company has published a brochure, "Respected Friend." This booklet tells the story of the company from its beginning in 1831 when the founder, Joseph Elkinton, opened a soap and candle factory in Philadelphia. Joseph Elkinton had been trained as a silversmith but the manufacture of soap and candles appealed to him as a more suitable profession for a serious-minded Quaker.

The business grew steadily and in 1855 Elkinton took his two sons, Joseph S. and Thomas, into the firm. Thomas showed particular enthusiasm for the technical side of the business. He was intrigued by an article in a scientific publication describing silicates of soda and in 1858 he set about experimenting with the chemical. Today, silicate is universally recognized as an important basic ingredient in soaps and synthetic detergents.

As the kerosene lamp began to take its toll of the candle business, the company shifted its facilities to the production of silicate of soda while continuing to make soap. Continued discovery of new applications for silicates caused the firm to abandon soap production in 1905.

Among the products first produced commercially by this firm are sodium metasilicate, sodium sesquisilicate, and an amorphous, finely divided silica.

Soluble silicates are used in such industries as foundry and metal cleaning, refractories, ore flotation, soap, paperboard, textiles, and oil.

The company now operates plants in seven states outside Pennsylvania.

casting | through the ages

TERMS AND CONDITIONS OF SALE

OF THE

GRAY IRON FOUNDRY INDUSTRY

(Originally Approved by The National Association of Purchasing Agents: March 11, 1931 and Reapproved With Amended Paragraphs 2 and 16 on September 19, 1949)

GENERAL CONDITIONS

All quotations are made and all castings are sold upon the following terms and conditions:

1. Unless otherwise agreed, quotations must be accepted and patterns furnished the foundry within thirty (30) days from date of quotation.

2. All castings are sold as unmachined castings, with heads, gates, fins and similar extraneous metal removed, f.o.b. cars, foundry point. Terms—thirty (30) days net, from invoice date, unless otherwise stated.

3. Claims for error in weight or number must be made within ten (10) days after the receipt of castings.

4. Foundry is responsible for the replacement of castings rejected due to foundry defects and such castings must be reported and returned to the foundry within ninety (90) days after their receipt. Foundry is not responsible for machine work, welding, labor charges or other losses or damages caused by defective castings unless otherwise agreed in writing.

5. Foundry is not responsible for loss of or damage to patterns by fire or other casualties beyond its control.

6. Foundry shall not be liable in damages for failure to deliver as a result of fires, strikes, differences with employes, accidents or other causes beyond its control.

QUOTATIONS

7. Blue prints submitted for estimating purposes should be marked with rough casting weight, if known, or an estimated weight upon which quotation will be based. A detailed description of the pattern equipment should be furnished.

8. When quotations involve the making of piece prices, definite weights shall be established and agreed upon, and quotations shall be subject to revision on any variation from the established weights.

9. Unless otherwise specified by the foundry, quotations are based on castings with gates, fins and other projections removed to approximately the contour of the pattern.

ORDERS

10. No order shall be changed unless notice of revision is made and accepted in writing before work is in process. If work is in process, customer is to be charged for any castings made as well as cost of cores, molds or equipment discarded because of such changes.

11. Cancellations of orders are to be made only by mutual consent of buyer and seller.

12. Unless otherwise stipulated, the customer shall accept an overrun of ten per cent above quantities specified on order. However, the foundry is to make an effort at all times to furnish as near the exact quantity specified as operating conditions will permit.

13. If customer requires special production service to secure unusual deliveries, an extra charge shall be made.

PATTERNS & CORE BOX EQUIPMENT

14. Customer must supply pattern and core box equipment in condition to produce economically the quality and quantity of castings required.

15. An extra charge will be made if patterns require stopping off or if skeleton or sweep pattern equipment is furnished.

16. Foundry is not responsible for variations existing between blue prints and pattern and core box equipment supplied by customer. If requested by customer, foundry will check patterns and core box equipment with blueprints at customer's expense, unless otherwise agreed to by the foundry.

17. All patterns, core boxes and loose pieces thereof, should be marked properly for identification.

18. Follow boards, core driers and similar devices when required, are to be furnished by customer.

19. Repairs and changes to patterns by customer's orders will be made at expense of customer.

20. All freight, drayage, boxing and crating charges on patterns, both to and from the foundry, shall be assumed by customer.

21. Pattern storage facilities are provided by foundry for active patterns only. Patterns not in use for a period of six (6) months will be returned to the owner or will be subject to storage charges.

Compiled and Published by Gray Iron Founders' Society, Inc., National City-E. 6th Bldg., Cleveland 14, Ohio
Eighteenth Printing—1955

FORM NO. TCS 2M 11-55

These recommended terms and conditions of sale have recently been published by the Terms and Conditions of Sale Committee of the Gray Iron Founders' Society. On the next page are suggestions to castings buyers.

SUGGESTIONS TO BUYERS OF GRAY IRON PRODUCTS

The following suggestions to buyers of gray iron products are offered for the purpose of enabling gray iron foundries to better serve their customers. It is believed that these recommendations, if followed, will avoid misunderstandings, promote greater accuracy in estimating on new work, and result in the purchaser receiving the best possible castings and service. It is suggested that the following information be supplied to foundries which are asked to quote on new work:

1. Kind of iron. Standard specification (preferably one promulgated by the American Society for Testing Materials) or description of industrial application or service requirements which the castings must satisfy.

2. Sample casting or detailed drawing or both—drawing should show: (a) name and number of parts, (b) *actual or estimated weight of the casting*, (c) important dimensions, (d) dimension tolerances, (e) surfaces to be machined and amount of finish to be allowed, (f) special requirements, such as finish, testing, gaging, special tolerances, disc or special grinding, drilling, tapping, etc., and (g) specific location for symbol or pattern numbers or trade marks and type of symbols or numbers preferred (raised or sunken).

3. Number of pieces to be ordered off each pattern with delivery dates and schedules.

4. Description of available pattern equipment and its condition, indicating type of patterns. If *loose*, the number of patterns and whether suitable for mounting on plate, specifying loose pieces, if any. If *gated*, number of patterns on gate; if two or more different patterns are on the same gate, whether equal quantities of castings off all different patterns will be ordered. If *plated*, number of patterns on plate, indicating plate material (steel, aluminum, wood, etc.) and for what size flask. If *cope and drag*, number of patterns on board and for what size flask.

5. Material from which pattern is constructed: wood (hard or soft), brass, aluminum, white metal, iron, etc.

6. Number of core boxes. Kind and type, such as: dump, split, loose pieces; number of cores per casting; number of cores to each box; material from which core box is made; whether designed for core blowing machines; number and kind of core dryers, core gages, scribbing jigs, etc.

7. If no pattern is available and foundry is to provide pattern at customers' expense, customer should state whether substantially permanent patterns are to be constructed. *If the foundry is not to provide patterns or special flasks it should be consulted as to how such equipment should be made.*

8. Description of flasks, if available. Quantity, size, cope height, drag height, type and construction (steel, aluminum or wood) should be given.

9. Special tests. If pressure tests are required, indicate nature of test and where and by whom to be performed. If mechanical property tests are required and test bars are to be provided, specify nature of tests (as per A.S.T.M. or other specifications) and where and by whom tests are to be made.

10. State whether piece prices or per-pound prices are desired, f.o.b. point, and whether separate price on pattern equipment is wanted.

11. Indicate any special crating, marking, packing or routing desired.

12. Indicate special treatment, if any, such as sand blasting, pickling, annealing, heat treating, normalizing, japanning, painting, enameling, etc.

13. Describe in detail any difficulties encountered in connection with the same casting purchased previously.

14. Make it a point to confer with a foundryman regarding castings requirements before the patterns are made - preferably while the design is still on the drafting board. Through suggestions based on experience, he can often help you get castings best suited to your needs.

(For Terms and Conditions of Sale of the Gray Iron Foundry Industry see reverse side)

Make it better  *with Gray Iron*

Sad Tale of Bessie the Barmaid

"Oh mother, dear mother, I walked
past the foundry
The workmen all whistled at me pass-
ing by.
There's a coremaker there who is
tall and so handsome,
A little mustache and a gleam in
his eye."

"Daughter, dear daughter, now hear
your old mother.
Walk right by the foundry—don't ever
go in.
For snoose and bad whiskey flow
right down the gangways,
A lewd den of vice and a hotbed
of sin."

"Mother, dear mother, I went in the
foundry
And saw my coremaker with the
gleam in his eye.
Though your warning be true and
you mean it sincerely,
If I cannot have him I know I will
die."

"Bessie, dear daughter, now hear
your old mother
Who took the wrong road and is
sorrowing still.
'Twas long years ago that I fell for
a sand man;
Believe me, dear daughter, I've been
through the mill!"

"Mother, dear mother, I'll heed to
your warning
Though with longing and sorrowful
tears I am choked.
Without my coremaker I know I will
perish."—
And with these sad words she keeled
over and croaked.

From *Rammed Up and Poured*, book of foundry poems by Bill Walkins, former sand mill operator, editor of *The ESCO Ladle* of Electric Foundry Co., Portland, Ore.

But your temperature is normal.

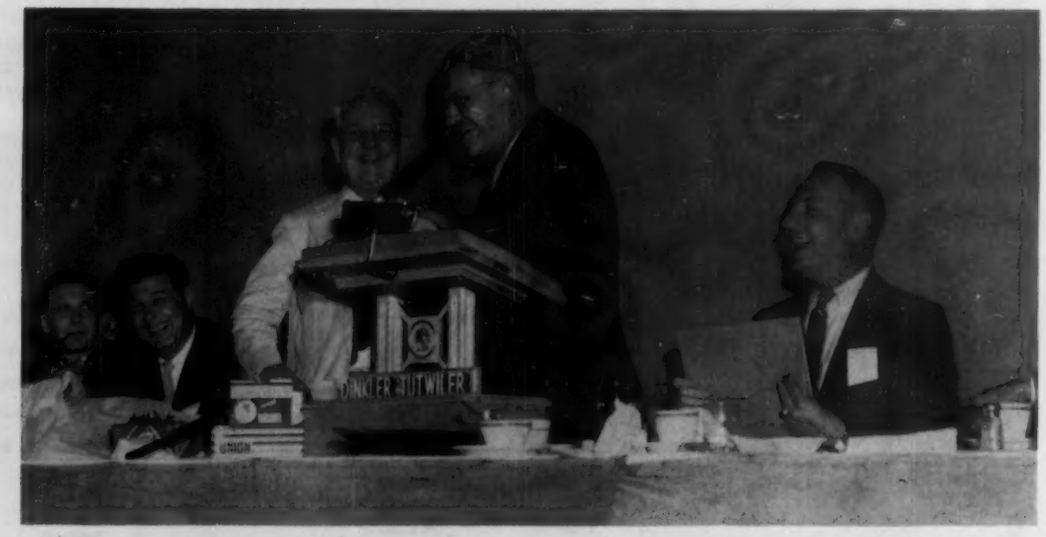
local foundry news

Connecticut Chapter members pulled their chairs up to the round tables for discussions at their May 22 meetings. This was the gray iron discussion group that dug into questions of general foundry practice.

Philadelphia Chapter's recent meeting was also a round table discussion. The discussions were divided into gray iron, brass and bronze, and steel. At the gray iron round table were discussion leader John Ahnsbach (right) and speaker E. H. Enderlein. All groups has speakers who presented talks before the discussions were started.

Two past presidents of AFS unable to attend the Atlantic City Castings Congress received their past president's awards in a ceremony at a **New England** Chapter meeting. Both past presidents are members of the chapter. Left to right: A. B. Root, Jr., AFS president, 1925-26; A. M. Nutter, president of New England chapter; Egbert H. Ballard, AFS president, 1931-32.

These past presidents of the **Wisconsin** Chapter got together during the Castings Congress.



Dr. J. T. MacKenzie considers Warren Whitney's remarks about useful gifts presented "Dr. Mac" by the **Birmingham** Chapter in recognition of his service to AFS and to the Birmingham Chapter.

As the year slides into the summer vacation period, and as AFS chapters turn from technical and business meetings to summer activities, most chapters make it a point to recognize those who have served well and faithfully. The type of recognition may vary: some of the men who have labored in the chapter's ranks are recognized by election to high office; those who are retiring after serving in office are honored; and those who have added another year to long records of service in the industry are recognized. Below are four pictures recording recent recognition activities in AFS chapters.

Harold R. Wolfer takes office as **Washington** Chapter chairman.

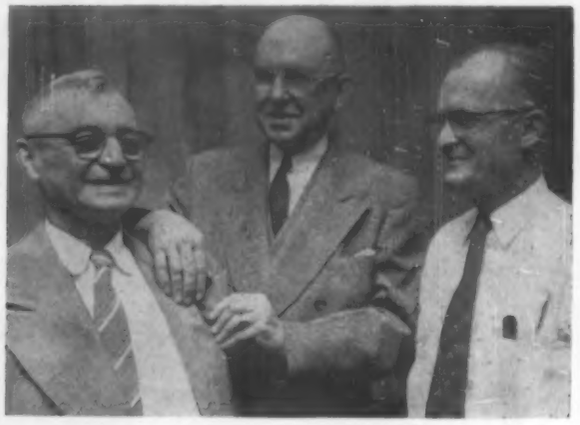
Outgoing **Wisconsin** president Charles Fuerst turns the gavel over to the new prexy, George J. Barker.

Eastern Canada's retiring chairman Wm. C. H. Dunn (right) gets pin from Morris McQuiggan.

Northern California got the word on foundry-pattern-maker relations from Paul H. Swizer.

WALT NAPP, MILWAUKEE CHAPLET

Wisconsin Chapter Oldtimer Joe Luber gets his badge of honor from chapter greeter C. A. Gehrman.



R. E. Gann gets his Fifty-Year AFS button from F. M. Robbins and W. B. Greiser, **Tennessee** chairman.

CALMO ENG. CO. PHOTO

"Elements of Supervision" were taught to these graduates of a 14-week class sponsored jointly by the **Southern California** Chapter and by Non Ferrous Founders' Society. James Dunbar, Special Instructor, Dept. of Industrial Education, State of Calif., taught the class. Attending were: front row, Ray Dorsey; Carl Bojarzen; Dunbar; Southern California Chapter Chairman William Baud; Dan Boone; Frank Elwell. Back row, Paul Koenig; Edward Haines, chapter educational chairman; Walter Haffling; Robert Basshardt; Martin Dietl; Emil Peshke; Arthur Falk; Paul Crow; Al Bailey; C. J. Egetter, first vice-president of NFFS; Donald Harper, Jr. Absent were Charles Gregg and Pasquale Arpea.

The advent of warm weather apparently put Michigan foundrymen and foundry students on the move. Here, members of the **Central Michigan** Chapter inspect the operation of a shell molding line at the Foundry and Heat Plant, Ford of Canada, Ltd., in Windsor, Ont.

Michigan State University Student Chapter toured General Motors' Saginaw Malleable Iron plant where they watched shell and green sand molding, coremaking, melting, and cleaning. Jack Lane, chairman, is in the left foreground; Professor Frank Flory is in the right foreground; and C. C. Sigerfoos, chapter advisor, is in the center of the picture.

New officers of **Oregon** Chapter are: seated, R. M. Burns, treasurer; H. K. McAllister, vice-chairman; F. M. Menzel, chairman; J. W. Goehler, secretary. Standing are the new directors: J. W. Smith, A. C. Sears, Harry Czyzewski, John F. Oettinger, and Norman E. Hall.

Among the 90 foundrymen attending the Gray Iron Founders' Society Third Annual Regional meeting at Palo Alto, Calif., were: Gordon Martin, James Pinkerton, Charley Gregg, D. Robertson, Al Sanchez, D. H. Workman, Earl Paltenghi.

continued from page 59

Gas pressure switch for multiple burner gas installations is presented in Spec Sheet S1011-1. A sealed pressure chamber prevents gas from escaping in event of diaphragm rupture. *Minneapolis-Honeywell Regulator Co.*

CIRCLE NO. 83, PAGE 13-14

Furnace conversion is the topic of 12-page Bulletin B-103. It's a reprint that tells how to convert acid electric furnaces to basic. Considerable technical data on the differences is included. *Basic, Inc.*

CIRCLE NO. 84, PAGE 13-14

Welding equipment is listed in 20-page buyers' guide designated GEC-1033. Illustrated guide covers all types of equipment, electrodes, and accessories, with ratings, dimensions, and specifications. *General Electric Co.*

CIRCLE NO. 85, PAGE 13-14

Steel conveyor belts which will handle more than 90% of all conveyorized processes requiring the durability and strength of a steel belt are discussed in 16-page booklet, "Steel Processing Conveyor Belts". *Colorado Fuel & Iron Corp.*

CIRCLE NO. 86, PAGE 13-14

Control of waste, both in time and material, is described in a 4-color booklet. Low-cost service consists of a plan involving posters, bulletins, reminders, etc. to make workers conscious of waste. *Clarkson Co.*

CIRCLE NO. 87, PAGE 13-14

Muffler for air-operated equipment is described in 8-page booklet "Noise Control". Booklet contains a general discussion of industrial noise, then goes on to detail applications and performance of the muffler. *Allied Witan Co., Inc.*

CIRCLE NO. 88, PAGE 13-14

Hardening cores and molds with carbon dioxide gas is discussed in 16-page "The CO_2 Foundry Process". Information is based on facts compiled by technical experts, and includes advantages, problems and solutions, methods, and materials. *National Cylinder Gas Co.*

CIRCLE NO. 89, PAGE 13-14

Expendable pallets are discussed in a technical pamphlet, "What You Should Know About Expendable Pal-

Binder and sands for the carbon dioxide process of making cores and molds are talked about in 4-page "DonCO$_2$" booklet. Good presentation, good writing, sound information. *International Minerals & Chemical Corp.*

CIRCLE NO. 91, PAGE 13-14

New publication called "Refractories" is due out every two months. It started this year with a discussion of heat conductivity. *The Carborundum Co.*

CIRCLE NO. 92, PAGE 13-14

Pyrometers and resistance thermometers for industrial processes are shown in 2-page bulletin GEC-1324A, listing features, accessories, applications, specifications and special calibration. *General Electric Co.*

CIRCLE NO. 93, PAGE 13-14

Clay products data sheet and price list gives information on several types of refractory strainer cores, splash cores, and gate tubes. *Universal Clay Products Co.*

CIRCLE NO. 94, PAGE 13-14

Publication for the foundryman leads off with a discussion of sands other than silica. "The Modern Foundry", No. 1, 1956. U. S. circulation is on a selected basis. *The Modern Foundry Publishers.*

CIRCLE NO. 95, PAGE 13-14

Shell processing machinery given in 16-page Bulletin 6000 includes shell mold machinery, shell blowers, shell sand mullers, strippers, controls, and electric furnaces. *Beardsley & Piper Div., Pettibone Mulliken Corp.*

CIRCLE NO. 96, PAGE 13-14

Maintenance products and services are given in 16-page Booklet PP-4. For boilers, oil burners, water supply systems, condensers, air conditioning and cooling systems, etc., *The Perolin Co.*

CIRCLE NO. 97, PAGE 13-14

Foundry ceramics that withstand heat shock are presented in 4-page Bulletin 532, showing strainer cores, cut-off cores, gate tubes, troughs, and precision cores. *American Lava Corp.*

CIRCLE NO. 98, PAGE 13-14

Gas analyzers of the thermal conductivity type are specified in Data Sheet 10-15-8a. These analyzers are used

for combustion control, continuous analysis, and production mixing of gases. *Minneapolis-Honeywell Regulator Co.*
CIRCLE NO. 99, PAGE 13-14

Thermocouples and radiation detectors for industrial control are shown in 40-page Bulletin F-5228-3. Contents include standard temperature-millivolt equivalents, much other practical information. *Wheelco Instruments Div., Barber-Colman Co.*
CIRCLE NO. 100, PAGE 13-14

Resin-coated sand for shell molding is the subject of new 16-page booklet. Topics include resins, sands, equipment, techniques, production, and trouble-shooting. *Monsanto Chemical Co.*
CIRCLE NO. 101, PAGE 13-14

Heat treating ductile iron is the title of an 8-page technical reprint. Five graphs and a table summarize commercial processes for developing tensile strength from 60,000 to 150,000 psi and elongation to 25%. *The International Co., Inc.*
CIRCLE NO. 102, PAGE 13-14

Shock mounts for industrial equipment are covered in 8-page Bulletin 1000. These mounts are all-metal, with stainless steel cushions. Applications, dimensions, load ranges are listed. *Robinson Aviation, Inc.*
CIRCLE NO. 103, PAGE 13-14

Iron powder processes for cutting, scarfing, gouging, lancing and washing are outlined in 4-page Form 1051. Advantages listed include uniform flow, hotter flame, cleaner cut, less smoke, less powder used. *Hoeganaes Sponge Iron Corp.*
CIRCLE NO. 104, PAGE 13-14

Vibrating conveyors and processing equipment are shown in Bulletin 112. These units are natural frequency conveyors, with all stresses distributed throughout their entire length. Spiral conveyors, feeders, and shakeouts are also included. *Carrier Conveyor Corp.*
CIRCLE NO. 105, PAGE 13-14

Shell molder and bonder are presented in 4-page, 2-color Catalog 4 that reports more production, greater economy, more safety, longer life. Includes dimensioned cutaway sketches and specifications. *Shell Process, Inc.*
CIRCLE NO. 106, PAGE 13-14

Refractory gun for lining cupolas is detailed in 4-page "Cupoliner 1500" brochure. This is a de-luxe unit for big jobs or multiple installations. Its tested principles have been devel-

oped and mechanized for simple operation. *International Minerals & Chemical Corp.*

CIRCLE NO. 107, PAGE 13-14

Phenolic resin for producing cores by the RCI process is presented in Technical Bulletin F-5. This is a liquid, water-soluble phenolic that cures very quickly. *Reichhold Chemicals, Inc.*

CIRCLE NO. 108, PAGE 13-14

Design study shows how a spring equalizer originally fabricated from 4 pieces of steel was redesigned to a steel casting with many advantages. It's told in *Product Design Studies*, No. 74. *Steel Founders' Society of America.*

CIRCLE NO. 109, PAGE 13-14

Plastic tooling pamphlet tells how tooling compounds based on epoxy resins provide direct savings in initial investment, savings to 80% in some cases. "Why Plastic Tooling?" lists 39 applications. *Bakelite Co.*

CIRCLE NO. 110, PAGE 13-14

Flexible pipe nipples for strain-free connecting of air or gas lines to industrial oil or gas burners are detailed in 4-page Catalog 708B. A good selection table is featured. *Hauck Mfg. Co.*

CIRCLE NO. 111, PAGE 13-14

Epoxy resins and how to use them are covered in "Plastics in the Foundry Industry," 6-page technical bulletin. Contents tell about loose patterns, match plates, core prints, core boxes, core driers, and patching. *Marblette Corp.*

CIRCLE NO. 112, PAGE 13-14

Air tools and accessories listed in 64-page Catalog 54-A range from drills, nut runners, grinders, and chippers to sand rammers, wood borers, and filters. All are specified and pictured. *Cleco Div., Reed Roller Bit Co.*

CIRCLE NO. 113, PAGE 13-14

Ethyl silicate for precision casting is detailed in 18-page technical booklet, "Montrose Silicates". Contents cover hydrolysis, gelation, settling and hardening, formulae, solutions to typical problems, etc. *R. W. Greeff & Co., Inc.*

CIRCLE NO. 114, PAGE 13-14

Circuit restorer for thermocouples is diagrammed and described in 8-page Catalog R-26. This device renews proper electrical conductivity in thermocouple circuits for heat-treating, melting, etc. *Electronics Div., Peerless Electric Co.*

CIRCLE NO. 115, PAGE 13-14

afs chapter meetings

JULY

20 . . Philadelphia . . *Manufacturers' Country Club, Oreland, Philadelphia. Annual Picnic and Outing.*

27 . . Wisconsin . . *Tuckaway Country Club, Milwaukee. Annual Golf Outing.*

28 . . Northwestern Pennsylvania . . *Erie, Pa. Annual Picnic.*

30 . . Twin City . . *Midland Hills Country Club, St. Paul, Minn. Annual Golf Tournament.*

AUGUST

11 . . Chicago . . *Lincolnshire Country Club, Crete, Ill. Annual Golf Outing.*

SFSA Safety Contest Underway

The 1956 National Steel Foundry Safety Contest is now underway and will continue through July and August. The contest is sponsored annually by the Steel Founders' Society of America for all foundries producing steel castings.

Competing groups are divided into exposure man-hours below 30,000; 31 to 55,000; 56 to 100,000; and 10,000 up. The rules of the American Standards Association apply in the determination of lost time injury frequency rates. A complete summary of regulations governing the event are available through the group's Safety Committee, 606 Terminal Tower, Cleveland 13.

The Safety Committee has also announced the winners of the 1956 Safety Poster Contest. 327 entries were received from 72 different companies. All entries are the work of employees of steel foundries.

From the entries, four were selected as national winners. They were: Benjamin Avery, Oklahoma Steel Castings Co., Inc.; Miss Irma Burke, Blaw-Knox Co., Continental Foundry & Machine Div.; Anthony J. Norris, General Steel Castings Corp.; Earl Hedgepath, Oklahoma Steel Castings Co., Inc.

advertisers and their agencies

This index is published as a convenience to the readers. While every care is taken to make it accurate MODERN CASTINGS assumes no responsibility for errors or omissions.

classified advertising

**For Sale
Help Wanted,
Personals,
Engineering Service, etc.,**
set solid . . 20c per word, 30 words ($6.00) minimum, prepaid.

Positions Wanted
. . 10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of **Modern Castings,** counts as 10 additional words.

Display Classified
. . Based on per-column width, per inch . . 1-time, $15.00; 3-time, $13.50 per insertion; 6-time, $12.50 per insertion; 12-time, $12.00 per insertion; prepaid.

HELP WANTED

WANTED: CORE ROOM FOREMAN Opening at once in large Western Pennsylvania gray iron foundry for competent Core Room Supervisor. Nationally-known manufacturer expanding present plant facilities. This is a permanent position. Excellent opportunity for the right man. Please give personal data in detail including age, experience, present compensation, etc. Include recent photo if available. All replies will be treated confidentially. Write **Box C144 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

WORKING FOREMAN for Aluminum sand castings. Must know gating, sand and metal temperatures. Chance to take complete charge. 30-45 years. Salary plus. **Box C145 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

SALES REPRESENTATIVE

Midwest Foundry Sand Company offers excellent opportunity for aggressive young man—age limit 40 years—to travel Midwest territory selling foundry sand. Must be experienced in all phases of molding and foundry operation. Salary and commission. Send detailed resume giving experience, training, education and salary requirements in first letter. Replies confidential. **Reply Box C128, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

BRASS FOUNDRY SUPERINTENDENT: Must have working knowledge of brass metallurgy, at least 10 years of permanent mold, die cast or sand foundry experience, under 50, salary open. Chicago area. Address reply to **Box C139, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

ONLY THE BEST We need competent metallurgist who likes people—therefore enjoys success in technical sales; who knows ferrous melting; who likes to guide his own destiny—therefore aspires to management; who is resourceful, imaginative, creative — therefore above average. Knowledge of tool, stainless, superalloys desirable. Home base will be Detroit area. Tell us about yourself and we'll do the same. **WAIMET, 1999 Guoin, Detroit 7.**

ELECTRICIAN—Assistant to Chief General maintenance of electrical equipment and instruments in Steel Foundry that employs 650. Applicant must have knowledge of basic electronics, engineering degree preferred but not essential. Foundry experience necessary. Should be familiar with arc furnace rectifier type welders, pyrometers and recorder controller instruments. **Box C 150 MODERN CASTINGS Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY ENGINEERS Well established metal warehouse, handling foundry alloys has need for salesmen to call on iron and steel foundries in Midwest. Salesmen to work out of Chicago and Milwaukee warehouses. Address Box C111, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.

MOLDING FOREMAN Midwest Foundry producing carbon and low alloy steel castings has an opening to supervise production of small and medium machine molded castings. Box C148 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.

POSITIONS WANTED

FOUNDRY ENGINEER or SUPERINTENDENT B.S. in chemical engineering in 1938. Eighteen years experience in all phases of founding of brasses, bronzes, and nickel alloys. Know synthetic, natural sand control, metallurgical melting, and scrap control. Can rig patterns, and core boxes for blowing. Five years experience MTM administration in semi-jobbing and production foundries. Will relocate. Box C151 MODERN CASTINGS.

MANAGER—SUPERINTENDENT Practical grey iron foundryman, age 52, technically trained, graduate metallurgist with broad background of experience in jobbing, machine tool paper machinery and high production. Well versed in metal, sand control, molding, cores, etc. Very low scrap record also low production costs. Desires connection with reliable firm demanding results. Box C146 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.

FOR SALE

FURNACES FOR SALE

10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

BAER STEEL PRODUCTS, INC.
Box 1428
Boise, Idaho

PROFITABLE ALUMINUM FOUNDRY $40,000.00 back orders—small overhead and operation—only permanent mold jobbing foundry and sand casting shop in the Southeast—heat treat furnace—L-N Tape Recorder—controlled holding furnaces sales force will continue on 5% commission—all personnel will remain. This plant has unlimited possibilities and income. Priced for quick sale. Confidential. All replies answered. Box C147 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines.

WANTED TO BUY

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Name MFS Safety Winners

Malleable Founders' Society recently announced winners in its Fifth Annual Self-Improvement Safety Competition. The awards recognize those plants that achieve the greatest reduction in their accident frequency rate during the year. Plants are grouped according to number of employees.

Winners of 1955 were: West Virginia Malleable Iron Co., Point Pleasant, W. Va., Group I; Kirsh Foundry, Inc., Beaver Dam, Wis., Group II; Lehigh, Inc., Easton, Pa., Group III; Link-Belt Co., Malleable Foundry, Indianapolis, Ind., Group IV.

Lehigh, Inc., was able to make a 100 per cent reduction in its accident frequency rate by operating the year 1955 with no lost-time injuries. A repeat winner was the West Virginia Malleable Iron Co. which won in Group I. The firm won the first annual competition in 1951. In 1955 the plant reduced its accident rate by 51.1%.

Two plants, Lehigh, Inc., and Eastern Malleable Iron Co., Wilmington, Del., operated during the year without a lost-time injury. It was the second consecutive year that the Wilmington plant has operated without a disabling injury, so it was not eligible to win an improvement award this year.

Are You One of the 50?

■ Somewhere about 50 foundrymen are wondering whether the U.S. mail service has collapsed or whether the office of the American Foundrymen's Society has closed. The 50 are members of AFS who failed to put their name and address on the preprint request mailed prior to the 1956 AFS Castings Congress & Show. The requests are in the Technical Dept. but there's no way to tell to whom the preprints should be mailed. If you're one of the 50, let the Technical Dept. know and you'll get your preprints. Better check over your preprint list and send the correct numbers to guarantee receiving those you originally requested.

obituaries

J. P. Lawrence, one of the founders and chairman of the board of American MonoRail Co., Cleveland, passed away April 22. Mr. Lawrence was a graduate of Pennsylvania State Uni-

J. P. Lawrence

versity and worked for several years with E. I. du Pont de Nemours & Co. He was a past vice-president and director of the Material Handling Institute.

Samuel B. Hood, 71, foundry superintendent, Treadwell Engineering Co., Easton, Pa., since 1912, passed away recently. During World Wars I and II he was an advisor to the Foundry Div. of the War Production Board and was superintendent of the first foundry making commercial steel castings by the electric furnace process.

T. J. Peterson, 82, president and founder of Tamms Industries, Inc., Chicago, formerly Tamms Silica Co., died May 4 after an illness of two years. Mr. Peterson founded Tamms Silica Co. in 1911.

Peter Gordon, a sales and service representative for the J. R. Short Canadian Mills, passed away April 13 in Toronto. His wife predeceased him by one day.

Mr. Gordon was awarded the Order of the British Empire for his services as foundry consultant for the Canadian Wartime Shipbuilding Dept., and he was a former councilman and mayor of Fort Erie.

J. H. Sorensen, Columbus Foundry Co., Brooklyn, N. Y., an alternate director of the Non-Ferrous Founders' Society, was killed in an automobile accident April 28.

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